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Basic ID-Concepts

Concepts & Terms

Rune Pettersson
Institute for infology

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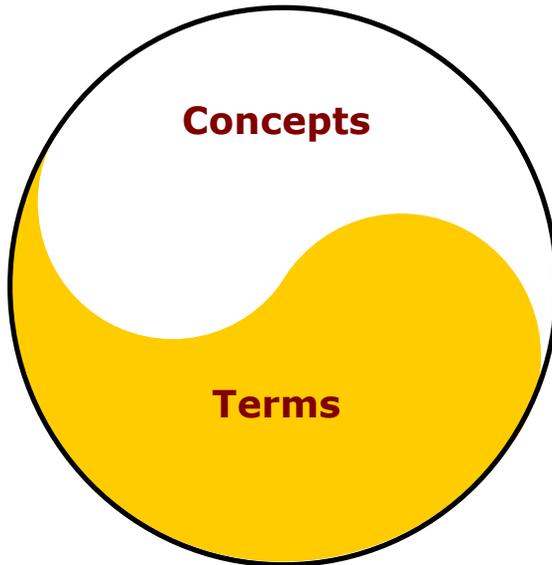
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Rune Pettersson * Institute for infology

ISBN 978-91-85334-23-0

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Tullinge 2013

Preface

Information Design is a multi-disciplinary, multi-dimensional, and worldwide consideration. It is not possible to develop a number of firm design rules telling the information designer exactly how to best design a message and develop information materials. However, based on research it is possible to formulate several ID-principles and then develop a number of guidelines for the design of effective and efficient messages and information materials.

Information design has theoretical as well as practical components and information designers need to have theoretical knowledge as well as practical skills. In order to perform sound reflections and make a qualified reflection regarding theory and practice, we need concepts both to structure our thoughts, and to describe them verbally.

In this sixth edition of *Basic ID-concepts* I present *short explanations* of some selected *basic concepts* in information design. All selections are based on my six books *Information Design 1–6*. Obviously my selection is very *subjective*. Other authors may very well make other selections.

November 2013

Tullinge, Sweden

Rune Pettersson, Ph. D.

Retired Professor of Information Design

Some figures

1 cicero = 12 points = 12 pt = .1780 inch = 4.511 mm in the *Didot* measurement system which is used in most parts of Europe (except Great Britain and France).

1 pica = 12 points = 12 pts = 1/6 inch = 0.1667 inch = 4.2333 mm in the *Pica* measurement system which is used in USAA and Great Britain.

1 PostScript point = 1/72 inch = 0.3527 mm.

1 pt (1) = 0.3504 mm in the *Mediaan* measurement system which is used in France.

1 pt (2) = 0.3528 mm in the *Pica* measurement system which is used in USAA and Great Britain.

1 pt (3) = 0.3759 mm in the *Didot* measurement system which is used in most parts of Europe (except Great Britain and France).

1 pt (4), 1 PostScript point = 1/72 inch = 0.3527 mm.

1+1 = 3 or even more is an important effect in information design. We can see two black lines as three lines, one white line between two black lines.

3 D-film, three dimensional film.

3 D-image, three dimensional image.

3 D-model. Contrary to a picture on a paper and similar to a real object a 3 D-model has height, width and depth. 3 D-models can only exist in the virtual world.

3 D-TV. three dimensional television.

3 pt, traditional name for Excelsior (USA), Minikin (Great Britain).

4 pt, traditional name for Brilliant.

4.5 pt, traditional name for Diamond.

5 pt, traditional name for Pearl.

5½ pt, traditional name for Agate (USA), Ruby (Great Britain)

6 pt, traditional name for Nonpareille.

6½ pt, traditional name for Minionette (USA), Emerald (Great Britain).

7 MT, Seven Management Tools for Quality Control, a set of methods for analysis of verbal data.

7 pt, traditional name for Minion.

7 QCT, Seven Quality Control Tools a set of methods for analysis of numerical data.

8 pt, traditional name for Brevier, Petit or Small text.

9 pt, traditional name for Bourgeois or Galliard.

10 pt, traditional name for Long Primer, Corpus or Garamond.

11 pt, traditional name for Small Pica or Philosophy.

12 pt (1) = 12 points = 0.1649 inch = 4.205 mm. in the *Mediaan* measurement system which is used in France.

12 pt (2) = 12 points = 1 cicero = 0.1780 inch = 4.511 mm in the *Didot* measurement system which is used in most parts of Europe (except Great Britain and France).

12 pt, traditional name for Pica.

14 pt, traditional name for English, Mittel or Augustin.

16 pt, traditional name for Columbian (USA), Two-line Brevier (Great Britain).

18 pt, traditional name for Great Primer.

20 pt, traditional name for Paragon.

21 pt, traditional name for Double Small Pica.

21st century literacy is the set of abilities and skills where aural, visual and digital literacy overlap. These include the ability to understand the power of images and sounds, to recognize and use that power, to manipulate and transform digital media, to distribute them pervasively, and to easily adapt them to new forms.

22 pt, traditional name for Double Small Pica (USA), Double Pica (Great Britain).

24 pt, traditional name for Double Pica (USA) Two-line Pica (Great Britain).

25.4 mm, size of the Anglo-Saxon compromise inch of 1959. In systems for desktop publishing twelve points make up a pica, and six picas make up an inch.

28 pt, traditional name for Double English (USA), Two-line English (Great Britain).

30 pt, traditional name for Five-line Nonpareil (USA).

32 pt, traditional name for Four-line Brevier (USA).

36 pt, traditional name for Double Great Primer (USA), Two-line Great Primer (Great Britain).

44 pt, traditional name for Meridian (USA), Two-line Double Pica (Great Britain), or Trafalgar.

48 pt, traditional name for Canon or four-line.

60 pt, traditional name for Five-line Pica.

72 pt, traditional name for Inch.

A

A series paper. Successive *A series* paper sizes are defined by halving the preceding paper size along the larger dimension. The most frequently used paper size is A4, 210 by 297 millimetres (8.3 in × 11.7 in). A standard A4 sheet made from standard 80 grams per m² paper weighs 5 grams. Size A0 is 841 × 1189 mm, A1 594 × 841, A2 420 × 594, A3 97 × 420, A4 210 × 297, A5 148 × 210, A6 105 × 148, A7 74 × 105, A8 52 × 74, A9 37 × 52, and A10 26 × 37 mm. The number after A accounts for the number of folds

Abac is a nomogram. See *Graphs*.

Abbreviation. The term *abbreviation* includes both normal abbreviations and *acronyms*. Define abbreviations in full the first time they appear in the text. Sometimes abbreviations may be defined in a special list.

Abstract. An abstract is a short summary of a document put in the beginning, below the author lines and above the body text. Abstracts often have a special font. The title *Abstract* may appear one line above the abstract text, or begin the first abstract line.

Abstract graphic symbols look like the objects they represent but have less detail than *pictorial symbols*. Good abstract graphic symbols are intuitive and we should be able to understand their meaning. In athletic contests, like the Olympic games, abstract graphic symbols are often used to denote the different sports.

Abstract image content is complicated to measure. We can ask people about their associations, about their ranking and rating of pictures. A subject matter can be depicted with different kinds of pictures and a single picture can be perceived in different ways.

Abstract subjects. Pictures of abstract subjects are understood in more varied ways than pictures with concrete subjects. Abstract subjects are described in concrete terms.

Academic disciplines change. Some areas of knowledge emerge and some disappear. At some point new areas get the status of new disciplines. Information design was deliberately “put together” with elements from different areas of knowledge. Basically this happened at the same time in different parts of the world, and information design of today has its origin and roots in different areas. See *Information design roots*.

Academic programs in information design vary. Information design is often part of an overall program, including graphic design, interface/interaction design, message design, technical communication, usability, cognitive and social sciences, business and media. Programs are both intra-disciplinary within art and design, and inter-disciplinary, based on the specific goals and objectives of the different programs.

Accuracy. When accuracy is needed in *graphs*, numerical arrays in pictorial form, and in *schematic pictures* the graphic information should be combined with actual figures. Colours like blue, red, and green are liked very much but they do not improve our possibility to read a message.

Achromatic colours are black and white. See *Natural Colour System*.

Acoustic shadow is an area through which sound waves fail to propagate, due to topographical obstructions or disruption of the waves via phenomena such as wind currents.

Acoustic signals may be used to convey warnings in many situations, e.g. fire alarms. See *Warnings*.

Acronym. An acronym is a pronounceable word formed from the first letter or letters of the significant words of a descriptive phrase, as in LASER (Light Amplification by Stimulated Emission of Radiation). The letters forming an acronym are capitalised and have no punctuation. Sometimes acronyms may be defined in a special list.

Active–passive. Avoid complicated word order and subordinated clauses. Use the active voice. It is usually more direct than the passive; it tells the readers exactly who or what is performing the action. Constant use of the passive voice can make your writing imprecise and difficult to follow.

Active space or *positive space* in a visual is the part representing different objects. *Negative space* or *passive space* is the part that is not filled with picture elements. The negative space is usually the background. Space has no meaning in itself, but it may be used to separate or bring together different picture elements.

Active voice. The active voice is usually more direct than the passive voice, and it tells the readers exactly who or what is performing an action.

Ad is a short form of *advertisement*.

ADDIE. See *Instructional Design*.

Additive colour. In a picture tube the *additive combinations* of the primary colours red, green, and blue lights (RGB) can produce a huge range of various colours. The additive colour combination starts in dark *adding* light to produce different colours. The end result is white. In this system the secondary colours are yellow, magenta and cyan. The coloured pixels do not overlap on the screen. When viewed from a distance, the light from the pixels diffuses to overlap on the retina in the eye. Projected additive light is used in theatrical lighting, such as concerts and plays. See *Subtractive colour*.

Adjunct information or *background information* is needed to fully understand any text. Explanatory information that is easily reachable places a text within a realm of understanding, as opposed to information without any additional easily accessible references.

Administrative documentation are important for documenting, filing, and saving information on events, prices, processes and products. Examples of common types of administrative messages are agendas (for meetings), calendars, directives (on work tasks), distribution lists, electronic mail, letters, lists (of various kinds), memos, minutes, summonses to meetings, and tables.

Administrative documentation history. Many contemporary business documents have their roots in the medieval book-keeping conducted by churches and monasteries. We can learn

a great deal by studying administrative routines in different organisations.

Administrative documentation objectives. Some of the objectives of administrative documentation are to show how to deal with various processes and issues, i.e. to explain, inform, report and describe.

Administrative documentation structure. The following information components can be used in maintaining functional administrative documentation: 1) A standardized layout for all kinds of administrative documentation in an organisation, i.e. ‘graphical templates.’ 2) A system for numbering documents. 3) A system for numbering versions. 4) Addresses. 5) Bank giro account numbers. 6) Dates. 7) Logotypes, 8) Postal giro account numbers. 9) Prose. 10) Tables.

Administrative documentation templates. Ready-to-use templates save time and contribute to the creation of a distinct and uniform structure for documentation and to a uniform identity for an organisation. Each organisation needs a carefully thought-out programme for its graphical profile. Many organisations utilize a set of governing ‘profile rules’. It must be easy for an organisation’s own employees, as well as external receivers, to find relevant information in each document. See *Administrative documentation structure*.

Administrative messages is a term for a group of information materials in the category *Administrative documentation*.

Administrative principles is the name of one of the four groups of message design principles. This category of principles

includes four design principles: *information access*, *information costs*, *information ethics*, and *securing quality*. See these terms and *Message design principles*.

Adolescent literacy refers to the set of skills and abilities that students need in grades 4–12 to read, write, and think about the text materials they encounter.

Adverbs. We should link sentences and paragraphs with conjunctions and/or adverbs (*although*, *and*, *because*, *but*, *even*, *however*, *moreover*, *nevertheless*, *or*, *since*, *therefore*, *thus*), making sure at the same time that the things linked together bear a logical relationship to each other.

Advert is a short form of *advertisement*.

Advertisement 1. Advertisement is the activity of advertising and attracting public attention to a business, product or service.

Advertisement 2. An advertisement is a paid announcement. Printed advertisements need a graphical form that arouses interest. Here unusual typefaces can be useful and stimulate attention, entice the reader to look at the pictures and begin reading the text. Shortened forms are *ad* and *advert*. Broadly interpreted certain kinds of advertisements can be included in the concept *information material*.

Advertising is generally regarded as the means for persuasion. Advertising presents positive images. It speaks to the heart as well as the head. We seldom expect advertisements to be objective and unbiased, and we should try to retain some preparedness for interpreting advertisements. When a message is re-

peated often enough, we may lose our ability to be analytical and critical about it. See *Persuasion design, Propaganda*.

Advertising and propaganda is a term for a category of information materials.

Advertising business. Advertising may be the world's most powerful industry. It is more powerful now than it has previously been at any time in history. We are exposed to a large number of advertising messages daily.

Advertising campaign. An advertising campaign is a form of mass-communication that can resemble both infotainment and factual information. It may change the public opinion. It can make a company's fortune, and it can put politicians in power.

Advertising effects. It is complicated to measure effects of advertising. People forget most advertising messages. However, advertising is used so frequently and is so pervasive in our daily lives that we often fail to recognize that we are exposed to it.

Advertising history. Advertising is not a new activity. Already 5,000 years ago crude advertisements appeared as inscriptions in Egyptian tombs. Later the Greeks engraved theatre ads in stone about 2,500 years ago. Signs of different kinds were hand painted on the lime-whitened walls of buildings in Rome and Pompeii.

Advertising literacy is an analytical concept with respect to media education and research. From the consumer point of view, advertising literacy is the individual's ability and skill of observation, recognition and understanding commercial mes-

sages. For the communicator advertising literacy provides directions for planning of advertising.

Advertising media. It seems that *all media* can be used for advertising. People in the advertising business tend to think about the advertising process as a traditional communications model. The advertising process involves a source or a sender (the advertiser), encoding (the professional in advertising), a representation with a message (the advertisement) and one or more channels (the selected media), noise (various obstacles), receivers (listeners, readers, viewers), decoding of the message (understanding), and feedback (the viewer's responses).

Advertising messages are common and we may be exposed to thousands every day. The elements of advertising messages are words, pictures, graphic design, music, sounds, characters, the setting, and the action itself. The more often a message is sent, the more familiar it becomes and the more likely it is to be remembered. See *Attention to advertisements*.

Advertising objectives. The objective of advertising is to sell ideas, products and services, although at times its purpose may also be to identify or to inform. While propaganda often creates negative images advertising presents positive images.

Advertising posters are used for advertising. See *Chéret, Toulouse-Lautrec*.

Advertising process. The advertising process involves a source or a sender (the advertiser), encoding (the professional in advertising), a representation with a message (the advertisement) and one or more channels (the selected media), noise

(various obstacles), receivers (listeners, readers, viewers), decoding of the message (understanding), and feedback (the viewer's responses).

Aerial perspective. The air is never absolutely clear. It is filled with greyish blue haze, moisture, and dust. This acts like a filter and makes distant objects seem obscure and wrapped in mist and they are partly hidden. As a consequence, objects viewed from a long distance seem indistinct and pale.

Aerial view. The term *aerial view* can refer to any view from a great height, even at a wide angle. Sometimes it is used for bird's-eye perspective. See *Bird's-eye perspective*.

Aerial viewpoint. Sometimes the term *aerial viewpoint* is used for bird's-eye perspective. See *Bird's-eye perspective*.

Aesthetic and usability. We could argue that the very moment that shape exceeds functionality is the point at which usability is compromised. However, we may also argue that art and aesthetic concerns in general serve a basic human need. We may say that artistry makes a thing more usable and useful by way of making it special. In information design functional properties are always more important than aesthetic properties. However, it may be an advantage if an information material also looks good.

Aesthetic criticism implies a judgement that utilises analysis, evaluation, feeling, and synthesis in the understanding of beauty.

Aesthetic literacy refers to interpreting and understanding of advertisements as a source of aesthetic pleasure and enter-

tainment. It includes the possibility of valuing the artistry and understanding the elegance of decisions in design, execution and production.

Aesthetic messages. See *Aesthetic value*.

Aesthetic principles is one of the four groups of message design principles. It includes *aesthetic proportion*, and *harmony*. See *Aesthetic proportion*, *Aesthetics*, *Harmony in design*, and *Message design principles*.

Aesthetic proportion is related to the appropriate and pleasing relations between elements in information and learning materials. This is one of two *aesthetic principles* in information design. The perception of aesthetic proportion is very subjective. We may all have different ideas of what we find beautiful and rewarding, and what we find boring, distracting, disturbing or ugly. When a design is *out of proportion* it may be disproportionate, exaggerated or overemphasized. Classical formats are based on the proportions of the *golden rectangle* (3:5, 5:8, 8:13, 13:21, 21:34, etc) and the *golden section* (1:1.618).

Aesthetic value of a message is how the intended receivers perceive it with respect to its beauty. Material with a (sufficiently) pleasing form has greater potential for conveying a particular message than does non-aesthetic material. With the invention of the printing press the publisher, or the art director, employed assistants to create typefaces for good legibility and high aesthetic value. More care could be given to illustrations, layout, and typography. Book pages were often decorated with borders and ornaments. Artistic and aesthetic values of each historical period have been dominating in traditional graphic

design. Since the time of Gutenberg the art and practice of graphic design has developed step by step, as new printing devices were invented and introduced.

Aestheticians try to understand art in broad and fundamental ways. They study art from all countries, and from all periods of history, in relation to their cultural, physical, and social environments.

Aesthetics may be defined as an appreciation of the beautiful. It is usually regarded as a branch of philosophy, along with epistemology, ethics, logic, and metaphysics. Aesthetics treats the conditions of sensuous perception and aims to establish general principles of art and beauty, and of harmony and proportion. Aesthetics is often divided into the philosophy of beauty, and the philosophy of art.

Affective use of colour. Colour enhances the attention and perception of a visual message. If people like the contents in a picture, they like them even more when the visual is presented in colour. From many experiments, it is clear that people prefer colour in visuals.

After publication. A picture analysis, i.e., a descriptive rating of a picture, and various practical tests can be carried out to determine whether or not an information disseminator's intentions are accurately realized. The results of these tests can be used for revision of the picture description that, in turn, could result in even more effective informative material.

Agate lines are vertical measurements of space. There are fourteen agate lines to an inch.

Age of Information. We need to learn how to handle various new situations. See *Information age*.

Agreement subject–predicate. The predicate (verb) in any sentence must agree in number with the subject. Words that come between subject and predicate do not affect the number of the predicate.

Agreements. The predicate (verb) in any sentence must agree in number with the subject. Words that come between subject and predicate do not affect the number of the predicate.

Agricultural literacy is a phrase used to describe programs to promote the knowledge and understanding necessary to analyze, synthesize, and communicate basic information about agriculture to students, producers, consumers, and the public.

Aha! learning focuses on comprehension and understanding based on insight. People acquire several little pieces of information until they see the whole—the “aha” experience. We must never assume that disseminated information is the same as received information.

Aid is a designation for the channel, or information carrier, and the equipment required for encoding and decoding of data.

Alberti. The multi-talented Italian classical scholar Leon Battista Alberti (1404–1472) is seen as a model of the Renaissance “universal man.” Alberti had a major influence on the Italian Renaissance and he was a predecessor to Leonardo da Vinci (1452–1519). He was a Renaissance scholar with crucial importance for the development of combined verbal and visual messages. He published his pioneering treatise *Della Pittura* (On

Painting), 1435. The Italian translation became an “inspirational handbook” with detailed practical instructions for active artists. Alberti described Filippo Brunelleschi’s mathematical construct of the central perspective. Alberti concluded that *beauty and harmony* of a building is more important than the actual purpose with the building and the resulting demands of suitable materials for the building. “Function follows form” became a leading doctrine in architecture and aesthetics for several hundreds of years. Today’s design motto is very much: “function can take any form.”

Albertus Pictor (about 1440–1509) is the most famous and prominent of all late medieval church decorators and painters in Sweden. In the latter part of the 15th century he and members of his workshop decorated the walls and vaults of over thirty small gothic style countryside churches around Lake Mälaren in central Sweden with fresco secco murals. The architectural structures with stone framework of ribbed vaulting provide natural frames for the different biblical scenes and messages. The texts in *scrolls* accompanying many paintings are important keys to the understanding of the function of the paintings and their messages. Some 6,000 paintings and accompanying text scrolls have recently been documented and examined by a group of scholars. This is a unique treasure of medieval art in northern Europe. No other medieval painter comes close to his achievement. Albertus Pictor was a skilled predecessor in information design—more than 500 years ago.

Alciato. The Italian lawyer Andrea Alciato (1492–1550) wrote a collection of short moralizing Latin epigrams in the emblem book *Emblematum liber*, or *Book of Emblems*. The printer/

publisher Heinrich Steyner included selected woodcuts in the book. Usually emblems have a header, a picture and an explanatory text. Steyner began a process that resulted in the recognition that a combination of text and pictures was a genre in its own right, and that the proper name for this new genre of illustrated epigrams was “emblems.” Andrea Alciato is called “the father of the emblem.” See *Emblem*.

Alignment chart is a nomogram. See *Graphs*.

Alphabetic languages. Most alphabetic written languages evolved from the Phoenician language that appeared around 1200 BC. The wide-ranging sea voyages undertaken by the Phoenicians spread their language to many places. It reached the Greeks in 800–900 BC. They added vowels to the Phoenician alphabet, which only consisted of consonants, and began writing from left to right instead of right to left. Many languages have alphabets based on the Greek alphabet, including the Latin of the Romans. Latin, in turn, has given rise to the alphabets employed in most modern written languages in Western countries. They use only a few dozen characters to represent thousands of words and concepts. English is often said to contain no less than 750,000 words. Many languages are closely related with respect to number of words. The systems of rules that govern spoken and written language are similar in many ways. Originally, writing was a way of depicting speech, but the two coded systems later went their separate ways. The most tangible feature of the rules for written language is their standardisation. In most western countries, the written language is comprehensible throughout the country and does not reflect differences in dialect. See *Signs and words*.

Alphabetic writing emerged in Egypt about 5,200 years ago. Ancient Egyptians often used papyrus scrolls for writing. Papyrus is a paper-like material made from a plant.

Alphabets evolved when characters designating words began to be used to represent the initial sounds of words. Alphabets have a standard set of letters. Letters, or groups of letters, represent phonemes of the spoken language. Alphabets typically use 20–35 letters. See *Alphabetic languages*.

Alphanumeric signs. Traditional database systems are usually based on alphanumeric characters. It is possible to search for text strings and numbers. In an image database, e.g. on a videodisc, pictures are usually assigned keywords and other alphanumeric information, which can later be used to find a particular image. However, it is impossible to search for iconic signs, for example structures in an image.

Amenhotep II reigned in Egypt from about 1,427 to circa 1,400 BC. In his mortuary temple in the Valley of the Kings at Thebes (KV35) the pillars supporting the ceiling have fully drawn figures of Amenhotep II with funerary deities. The hieroglyphic texts are of great importance as they contain a complete version of the *Amduat*. This book of the afterlife tells the story of *Ra*, the Egyptian sun god who travels through the underworld, from the time when the sun sets in the west and rises again in the east.

American Quarto. The most commonly used paper sizes in North America are called *Ledger*, *Legal*, *Letter*, and *Tabloid*. A letter size paper is 215.9 × 279.4 mm (8½ × 11 in). Letter size is also known as American Quarto.

Amount of information. The amount of information being disseminated is increasing every day. No signs indicate a paperless society, maybe a “less paper” society.

Amygdala in the brain is involved in the regulation of higher-order motivational states.

Analogue coding. Data are stored as continuous signals. These signals are often electrical, but they can be hydraulic, mechanical or pneumatic. Analogue coding takes up much less space than digital coding. Video data stored in analogue form is suitable, for example, for entertainment when sequential viewing of a program from beginning to end is desired. See *Digital coding*.

Analysis 1. During an introductory planning and analysis phase in the message and information design processes it should be possible to organize the work, analyse the intended message, define the purpose and the objectives, analyse the intended receivers and the information requirements, and select a suitable method for framing of the verbal and visual message. Unfortunately, many production teams may spend too little time and effort on this important phase. See *Message design processes*.

Analysis 2. Analysis is the first sub-process in the actual writing of a text. The different steps include defining the purpose and receivers of the intended message. See *Message design processes, Writing and drawing processes*.

Analytical drawings are schematic pictures working in concert with photographs. See *Drawings*.

Angular perspective is a *two-point perspective*. All lines vanish in two directions to two different vanishing points.

Angular type conveys cultural meanings. It is abrasive, brisk, controlled, decisive, harsh, masculine, modern, rational, and technical.

Animation may function as an important instructional tool that will attract and direct learner attention, explain complex system events, and show changes in colour, in direction, in flow, in opacity, in position, in processes, and in size. Simple animations often function better than complicated ones. We should use animation only when the instruction includes the use of motion and trajectory. Animations that allow close-ups, control of speed, and zooming are more likely to facilitate perception and comprehension. Even though animation can be useful as a learning tool it is still unclear when and how it should be used. In some situations animation can be disadvantageous. Animation is commonly used for cosmetic purposes, with the intent of impressing rather than informing.

Anomalies of colour vision, or *colour blindness*, is a condition in which certain colour distinctions cannot be made. This is more commonly observed among men than among women, with estimates ranging as high as 10% of the male population. Only 1% of the female population has abnormal colour vision. Failure to distinguish between red and green is most common. Both hues are perceived as grey. Common colours in graphic symbols are pure yellow, red, blue, green, white and black, or combinations of these. Unfortunately, red and green are often used as discriminating colours in symbols and in warning sig-

nals and signs. Since many colour-blind people perceive red and green as grey, colour can only be used to code the information redundantly. Colour may be combined with shape, and position, or with both, which is often seen in traffic signs.

Application of knowledge. After attention, perception, and processing of information we apply our new knowledge and test it in different applications for confirmation. It is important to use new knowledge. We will remember relevant and meaningful information if we have use for it. The usefulness of conclusions made by other people is limited. We must gain confirmation through our own experiences. The information must be internalized and made our property, as part of our memory.

Applications. From a process perspective new “applications” develop in concert with already established academic disciplines. Examples of are care and health care, culture and society, and technology and society. At the same time established areas of knowledge become less important. Some areas disappear. There may be many thousands of academic disciplines in the world. Some areas of knowledge have a practically oriented content, while others are mainly theoretically oriented. However, a number of academic disciplines have a practical as well as a theoretical content.

Applied research. To a large extent research in message design consists of applied research. This research has a pragmatic perspective on knowledge. New findings are tested and the results are confirmed in different environments and situations. Critically selected results from other research may often be used as starting points. It is possible to create guidelines for the pro-

duction of effective information and learning materials. Evaluation of the use of these materials provides useful information for further studies.

Approaches. An *artistic approach* tends to judge success by whether the product feels right and whether the critics like it or not. A *design approach* minimizes the need for rewriting and editing. The design approach judges its success by whether the product achieves the objectives specified by measurable performance objectives, within the specified resources and situational constraints. The focus is on workability.

Aquatint engraving is a type of etching specially used for areas with many shades and nuances. In tonal quality aquatint is similar to the wash effect of a watercolour drawing. Aquatint is often combined with other printing techniques, such as line etching. The method has been known since the 17th century. Graphic artists mainly use this method as a fine arts technique.

Arch is a series of paper sizes used in architecture. In this series the aspect ratios vary, 4:3 and 3:2 are common. Five successive paper sizes are defined by halving the preceding paper size along the larger dimension. Here the aspect ratio varies between 3:4 and 2:3. Arch A is 9 x 12 in (229 x 305 mm), Arch B 12 x 18 in (305 x 457 mm), Arch C 18 x 24 in (457 x 610 mm), Arch D 24 x 36 in (610 x 914 mm), Arch E 36 x 48 in (914 x 1219 mm), Arch E1 30 x 42 in (762 x 1067 mm), Arch E2 26 x 38 in (660 x 965 mm), and Arch E3 27 x 39 in (686 x 991 mm).

Archaeological cultures. Today archaeologists have named “archaeological cultures” based on characteristic ceramics with their decorations. Regardless of the expected short lifetime pot-

ters spent time on decorating their pottery, often with abstract patterns. Today pieces of pottery can often be used for dating of archaeological sites. Pottery analysis may also provide information about past cultural networking and communication patterns.

Architectural design. See *Information design genus*.

Architecture. See *Information design genus*.

Archive pictures. Frequent use of archive pictures in textbooks may cause quality problems. In many situations it may be better not to have any pictures at all than employing pictures not produced for the occasion. See *Photo archives*.

Archives. There are four main types of archives: 1) Personal, private collections. 2) Commercial photo agencies. 3) Personal research archives in different fields. 4) Collections in museums and other public institutions. See *Photo archives, Simple indexing*.

Area principle. We will interpret a small shape within a larger shape as the “figure,” and the larger shape as the “ground.” Our ability to distinguish the boundaries of an image is usually very high.

Area specific literacies. Several literacies are “area specific.” At the same time they may belong to more than one of the five main categories of literacy. Advertising literacy, aesthetic literacy, agricultural literacy, cultural literacy, diaspora literacy, ecological literacy, ecoliteracy, environmental literacy, health literacy, information literacy, informational literacy, media literacy, mental health literacy, mental literacy, political literacy, promo-

tional literacy, rhetorical literacy, scientific literacy, social literacy, technological literacy, and television literacy all belong in this category.

Area-based positional perspectives. This group includes *Aerial perspective*, *Colour perspective*, *Overlapping perspective*, *Shadow perspective*, and *Tonal perspective*.

Areas belong to the simplest components in visual language. An area can be varied with respect to brightness, colour combinations, colour, context, emptiness, grain, grey scale, non-shaded, shaded, shape, size, texture, and value. A colour, a line, a shade or a shape may describe an area. An area may have an abstract, a geometric, or a representational shape. In art shapes are often used to represent the real world. Picture elements with bold lines are perceived as more important than picture elements with thin lines. A square is an example of a static area. A rectangle is perceived as more active. The size of an individual area is always relative. It depends on our knowledge of its surroundings. See *Basic elements*, *Size of subjects*.

Areas of knowledge. The concept of *information design* is a more widely embracing one than the concept of *instruction design*. From a cognitive point of view, information design is less demanding than instruction design. In instruction design the receiver is to (usually) learn from the message. However, in communication design and information design the receiver only has to be able to understand the message in order to use the information in a practical situation. In many situations this will, of course, also result in learning. But learning is usually not required.

Argument messages based on facts are useful tools when the goal is to change an *attitude*. Such messages may also increase the credibility of the sender.

Art is valued for its originality and expressiveness. Its focus is on individual artefacts crafted through the manual and aesthetic virtuosity of the artist. Art strives to express fundamental ideas and perspectives on the human condition. *Design*, in contrast, is valued for its fitness to a particular user and to a particular task.

Art abstract styles are expressionistic style and cartoon style. Children equate abstract art styles with imaginative, “pretend” or “make-believe” literature.

Art criticism may be defined as the process of judging the aesthetic qualities of visual art, mainly architecture, painting, and sculpture, but also craft. This has become a specialised field, but judgements about works of art have appeared since ancient times. We can use three simple questions: 1) What is it? 2) What does it mean? 3) What is it worth? The answers to these questions result in a description, an interpretation, and an evaluation.

Art definitions. Usually definitions of art aim at establishing a set of characteristics applicable to all kinds of fine arts, as well as the differences that set them apart. After some hundreds of years of discussions aestheticians have not yet agreed upon a definition of art. Some say that it is impossible to define art.

Art experiences. It is a common belief that a person’s response to art is a mystical experience that has no basis in reality

and serves no practical purpose. But the opposite may very well be true. A positive response to art is a phenomenon of reality that may reflect a person's most important values. Another belief is that art is entirely subjective and cannot be evaluated on an objective basis. See *Perceptual aesthetics*.

Art interpretations. In aesthetics one area of study is concerned with the study of the interpretations of art, how people use, enjoy, and criticise art. Knowledge of psychology helps the aestheticians to understand how people act, desire, feel, hear, imagine, learn, see, and think, in relation to art and aesthetic experiences. See *Perceptual aesthetics*.

Art metaphysics. Some philosophers have concluded that works of art represent mental entities, such as visions and dreams. Other philosophers have noticed that artists may express their attitudes, emotions, and personality traits in their art, and have concluded that art works belong in a category with non-verbal communications rather than with physical objects. Still other philosophers argue that works of art exist only in the minds of their creators and of their audiences.

Art production. Main questions about the production of art deal with creativity, imagination, and the role of innate ability in any artistic production. Ancient and medieval philosophers assumed the same model for producing fine art and crafts. They had no conception that the two are distinct. The present distinction between the production of fine art and crafts emerged in Western culture after the renaissance. Today most aestheticians assume that something is unique about producing fine art.

Artefact design. See *Design science*.

Articulacy is the condition of being *articulate*, that is the ability of speaking in a clear and effective manner.

Artistic approach. An *artistic approach* tends to judge success by whether the product feels right and whether the critics like it or not. See *Approaches*.

Artistic layout may please the individual artistic graphic designer, but may have no relation to the content of the message.

Ascender. The part of a lower case letter that ascend above its x-height (b, d, f, h, k, l). These letters may be taller than the cap height.

Assessing image content. It is relatively easy to assess concrete image content, but not abstract image content. A subject matter can be depicted with many different kinds of pictures and a single picture can be perceived in many different ways. We need to further develop methods for measuring image properties. See *Picture analysis*.

Assign meaning. People do not derive the same information from things they hear, read, or see. The meaning of any language, verbal or visual, is not only resident in words or pictures but in ourselves. We have to learn the codes, and how they differ in different societies and in different cultures. We have to learn to assign meaning to language symbols. There must also be some overlapping in the fields of experience of the sender and of the receiver for communication to take place.

Associations. A text and a picture will give rise to many individual associations and interpretations.

Associative concept system shows relations, that is, functional relations, between different concepts. See *Conceptual models*.

Associative learning is among the most basic forms of learning. The learner builds an association between two stimuli, or between a behaviour and a stimulus. Learning is based on imitation and memorising with a strong emphasis on the intellectual ability of the teacher.

Associative perception. The reader ignores variation on one visual dimension when reading a picture. A visual variable is associative when it does not influence our perception of other dimensions in the visual variables. A visual variable is dissociative when it severely influences our perception dimensions in the visual variables.

Associative psychology. In accordance with associative psychology learning is based on associations. The “law of contiguity” states that mental associations occur when two events take place close to each other in space or in time. The “law of similarity” states that a person is likely to connect two things that are almost the same. On the other hand, the “law of contrast” states that greatly different things are likely to be associated. Thus, it is easier to learn the differences between “hot” and “cold,” than between “hot” and “warm.”

Attached shadow. See *Shadows*.

Attention. Among thousands of stimuli in the external context we only see, hear, smell, feel, taste, and “pay attention to” one stimulus at a time. Attention is sudden, direct, and distinct. The

sequential flow of attention to the parts of a message is determined by the sequence in which information is presented to us. There are always far more stimuli than we can ever notice at any given situation. Attention may be controlled 1) automatically, 2) by instructions, and 3) by the specific demands of the particular task at hand. See *Attention qualities, Attention to advertisements, Attention to colour, Attention to information sets, Attention to layout, Attention to movement, Attention to novelty, Attention to oral communication, Attention to pictures, Attention to symbols, Attention to text, Context, Emphasis in layout.*

Attention qualities. There are several attention models and attention theories. We can pay attention to the *content* of a message, to the *execution* of that message, to the *context* in which the message is presented, and to the actual *format* or *medium* that carries the message. Our attention will not last for long. Any material must constantly re-draw the attention to hold the interest of the viewer.

Attention to advertisements. Advertisements in different media must be noticed, otherwise they are completely useless. Here, unusual typefaces can be useful to attract attention to the text. In these situations the graphic form should stimulate attention, entice the reader to look at the headings and pictures and then actually begin reading the text.

Attention to colour. To some extent colour is a language of its own. Bold and bright colours may be used to enhance the attention to and perception of a visual message. Colour creates instant impact and it becomes a vital part of our first impression. The number of colour codes must be limited and they must al-

ways be explained. Improper use of colour can be distracting, fatiguing, and upsetting and actually produce negative results.

Attention to information sets. The intended message may be hidden within verbal or visual puns, within metaphors, satires, parodies, or within humour. In these cases, designers break the traditional rules or guidelines of instructional message design. A visual material must constantly redraw the attention to hold the interest of the viewer.

Attention to layout. Layout and typography should be transparent and not cause any specific attention in information and learning materials. When pictures cover an entire page this “bleed” beyond the text-face may expand the impact of attention-getting images. Irregular, unexpected, and unstable design will attract attention. Arrows, bullets, icons, underlining, margin notes, repetition, and/or white space can highlight the relevant information. Caricatures, cartoons and pictures that are tilted on the page attract attention. Each picture needs a caption to direct attention and interest. Put pictures as close to the relevant text as possible; between the appropriate paragraphs get maximum impact. Pictures on odd-numbered pages attract more attention than pictures on even pages.

Attention to messages. We are almost always paying attention to something, whether it is information in our environment or information already in our heads. Paying attention requires mental effort. Usually we can only attend to one thing at a time. One of the message designer’s first problems is to gain the attention of the audience, and thereafter she or he has the continuing problem of holding the attention.

Attention to movement. Our peripheral vision is especially sensitive to movement and brightness, both highly relevant to the detection of any approaching danger. When we look at a multi-image slide and film presentation it is obvious that we only have a limited capacity for attention. As soon as the film starts, our attention is directed towards the movement in the film from the surrounding stills. It is just impossible for viewers not to be influenced by the movement. The fact that one must select information implies that there are limits to the ability to perceive, think, or do several things at once.

Attention to novelty. Attention is drawn to changes and anything unusual, but not necessarily excessively bright, extraordinary, or loud stimuli. Attention is drawn to what is quantitatively different from what has been attended to previously. We need to find a balance between novelty and familiarity, between complexity and simplicity, between uncertainty and certainty. Familiarity in excess produces boredom, while novelty in excess produces anxiety.

Attention to oral communication. Various media may be used in oral communication in order to improve attention and perception. It is hard for the presenter to gain and hold the interest of the viewer/listener, who easily are distracted. It is easy to lose an audience, and hard to get it back.

Attention to pictures. Pictures attract attention, and may hold and maintain attention. People, especially our faces, will get maximum attention in images. Arrows and lines in various colours can attract attention to specific elements within a picture. Captions can effectively direct attention where the de-

signer wishes it to be directed within the picture. If people like the contents in a picture, they like them even more when the visual is presented in colour.

Attention to symbols. The receiver must be able to see or rather “discover” symbols. This is especially important for symbols on warning signs. Such signs should be put close to the hazard and need to have reflectance and good lighting conditions. It must be possible to see warning signs in degraded conditions such as fog, low illumination, or smoke. Arrows and lines in various colours can draw attention within information and learning materials and also for wayshowing.

Attention to text. Since there are over 60 000 different typefaces (with still more being introduced), it is easy to combine them in many ways. Most of these typefaces are, however, of limited value in information and learning materials. Usually only a few typefaces are needed. When text is shown on a visual display, there is no easily read colour combination. Rather than focusing on specific colours as always best, designers should work to ensure good contrast between text and background.

Attention time span. An attention time span is the length of time a subject can focus on an object or a topic. Our attention will usually not last for long. Any information material and any presentation must constantly redraw the attention to hold the interest of the viewer. A presentation may hold the viewer’s attention when the rhythm, layout, and pace are not predictable and boring. As children grow, their attention spans grow with them. They can concentrate on tasks for longer periods of time,

and can more easily “block out” objects and events that are irrelevant to a task at hand.

Attitude change. Adding illustration to text may fail to enhance attitude change. Results depend on how pictures are executed and how they are used. Association is facilitated when items are shown together.

Audial language comprises sound effects, music, and paralinguistic sounds (all aural). Audial language + visual language can be designated audiovisual. Many artistic slide-tape shows and multi-image presentations employing images, music, and sound effects belong to this category. See *Languages*.

Audibility in the spoken word is comparable to *legibility* in the written word. In oral presentations it is important that it is easy to *clearly hear* the individual words and sentences. See *Legibility*.

Audiences. See *Receiver groups*.

Audio messages should be audible, distinct, and well worth listening to for the intended audience.

Audio-visual instruction is now more or less an obsolete term. The audio-visual scholars of the 1920s and most of the 1930s followed prevalent theoretical and methodological trends in educational psychology. Texts were mainly concerned with operation of machines in public school classrooms. World War II research on instruction and training indicated that films were good at teaching facts, and adequate at developing attitudes. The texts of the late 1920s and early 1930s.

Auditory principles. Some visual Gestalt principles also apply in the acoustic domain. Silence or background noise, interrupted by a loud sound, followed again by silence or noise, is an auditory analogue of a figure on a ground.

Auditory modality. Children with *auditory modality* rely very much on hearing and verbalisation. They learn by hearing; they are “auditory learners.” Thus, these children remember names rather than faces. They learn from verbal directions and descriptions. They think in sounds. Auditory modality children talk a lot. They like to hear their own voices. Auditory learners miss significant details in pictures. However, they may appreciate a work of art as a whole. They favour music. See *Modality*.

Auditory threshold is the lowest sound intensity we are capable of perceiving.

Auguste Rodin (1840–1917) was a French sculptor. He worked in clay in an *object-oriented manner* and used the same form elements in several sculptures. He modelled the human body with realism and departed from traditional decorative tradition. The original sculpture *The Thinker* is 71.5 cm high (1888). Later a large number of bronze versions were made in various sizes. During the peak of his career Rodin had up to 50 assistants.

Aural perspectives. The ear is efficient in receiving and localizing sound within our environment. Our ears bring us a world of sound that has depth and distance. Any “soundscape” has three layers, or planes, of acoustical information. There are foreground sounds, context sounds, and background sounds. People have a natural ability to isolate sounds in relationship to

their approximate positions: behind, above, below, to the sides, or in front of the head.

Author lines are the lines at the beginning of a paper with the name of the author or the authors. It is often centred and set in smaller type than the heading.

Avant Garde is a common sans serif typeface.

B

B series paper. The *B series* is less common than the A series. The area of a B series sheet is the geometric mean of successive A sheets. The B-series is widely used in the printing industry. Many posters use B-series paper or a close approximation, such as 50 cm × 70 cm. Size B0 (B zero) is 1000 × 1414 mm, B1 707 × 1000, B2 500 × 707, B3 353 × 500, B4 250 × 353, B5 176 × 250, B6 125 × 176, B7 88 × 125, B8 62 × 88, B9 44 × 62, B10 31 × 44 mm.

Background information or *adjunct information* is needed to fully understand any text. Explanatory information that is easily reachable places a text within a realm of understanding, as opposed to information without any additional easily accessible references.

Baird. About 1925 the Scottish engineer and inventor John Logie Baird (1888–1946) produced some of the first successful television images. He was the first inventor to use Nipkow's disc successfully. On 26 January 1926, Baird made a demonstration for members of the Royal Institution and a reporter from *The Times*. It was the world's first publicly demonstrated television system, and the world's first fully electronic colour television tube. On 3 July 1928, Baird made a demonstration of the world's first colour transmission. John Logie Baird is known as “the father of television.” See *Nipkow*.

Balance is the sum of all elements, the darks and lights, the horizontals and verticals. A composition is balanced when the visual weight of graphical elements on either side of the centre of balance are approximately equal. Balance can be formal or

informal. Formal balance has total symmetry and it is felt to be static and harmonious. It may, however, also be boring. See *Balance in design, Balance in information materials, Balance in pictures, Composition, Harmony in design, Imbalance, Informal balance.*

Balance in design. Man has an intuitive sense of balance. When a single element is too large or small, too light or dark, too indistinct or prominent, the entire design will suffer from this imbalance. However, good balance is something subjective. As with a physical balance, lighter elements can balance heavier elements if their size or value is increased, or if they are moved farther away from the centre of balance. It is also possible to move the heavier elements closer to the centre of balance. See *Harmony in design.*

Balance in information materials. An information material should usually display good balance, in a manner, that is interesting but not distracting or disturbing. Different people may have quite different opinions on any aesthetic issues. Altering even a single attribute of one part in a complex composition could have a significant impact on the balance, the unity, and ultimately the harmony of the whole.

Balance in pictures. A picture should usually display the best possible balance. Elements of the picture should fit together in an aesthetic and harmonious relationship. Unexpected, irregular, and unstable design will attract attention. As soon as instability is introduced in a picture the result is a provocative visual expression. The eye will struggle in order to analyze the relationships and the balance within the picture.

Bands in typography are rules wider than 12 points. See *Rules*.

Bar chart is a schematic picture. See *Bar charts, Playfair*.

Bar chart map is a schematic picture. See *Maps*.

Bar chart is a diagram. This group includes: 1) Vertical bar chart, or column chart. 2) Horizontal bar chart. 3) Segmented bars. 4) Stacked bars. 5) Clustered bars, or multiple bars. 6) Overlapping bars. 7) High-low bars. 8) High-low close bars. 9) Enhanced high low bars.

Baroque period. The Baroque style began in Rome, Italy, and spread to most of Europe. This style produced drama, exuberance, and grandeur in architecture, painting, and sculpture. This is the intermediate phase between the Renaissance and the Modern age. Sculptures from the Baroque period focused on energy and passion. Baroque architects often used a sense of central projection, and strong colours on the interior of their buildings. See *Bernini, Light designer, Motion designer, Sound designer*.

Bars in typography are lines wider than 12 points. See *Rules*.

Basal ganglia in the brain are involved in complex action sequences.

Baseline. A baseline is a horizontal imaginary line, the main point of reference in typography. See *x-height*.

Basic elements, or *graphic elements*, are the simplest components in a picture. *Dots, lines, and areas* can be varied in many ways. Basic elements are sometimes meaningful, sometimes not. The number of ways in which the smallest image

components can be inter-combined is unlimited, and the importance of certain combinations varies from one picture creator to another. Dots, lines, and areas can be put together in many ways. Changes of the basic elements will result in different images, sometimes of great and sometimes of minor importance. Three-dimensional pictures also possess *volume* in different forms. Design of basic elements is important to consider. Most available patterns are probably less good. Patterns should be subdued and not disturbing. See *Areas, Dots in visual language*, and *Lines in visual language*.

Basic instructional team. See *Instructional technologist*.

Basilica of San Francesco d'Assisi. Building started in 1228. The basilica is built into the side of a hill and comprises two churches and a crypt. In 1253 Pope Innocent IV consecrated both churches. In the Upper Church 28 scenes show the events in the text *Life of St. Francis*. These 230 x 270 cm large frescos are placed on the lower part of the nave and on the inner facade on either side of the entrance wall and made from 1297 to 1300, maybe by Giotto. All 28 scenes have an accompanying explanatory inscription in Latin. These inscriptions were written below each painting, but they have aged and are now pale and practically illegible. Regardless of the aging process this shows that it was considered important to use combined verbal and visual messages—more than 700 years ago.

Baskerville is a common serif typeface, created by John Baskerville about 1757.

Bauhaus. The German architect *Walter Gropius* (1883–1969) was a pioneer in design. He was the founder and leader of the

Bauhaus School, 1919–1933. At Bauhaus the function of an object was crucial to its appearance. Bauhaus combined crafts and the fine arts. Eventually all arts would be brought together. The name Bauhaus refers to the medieval building hut. It was a meeting place for architects, builders, craftsmen and artists at major church buildings. The goal for all design was clarity, effectiveness, and objectivity. These objectives are now also important in information design.

Bayeux Tapestry is an embroidered cloth, which is 68.38 metres in length by 51 centimetres in height (224.3 ft × 1.6 ft). It is a visual narrative. 79 consecutive scenes depict the events leading up to the Norman conquest of England in 1066. It was made in a monastery in the south of England for the Bayeux Cathedral that was built in the 1070s. More than fifty scenes have Latin *tituli*, a form of captions. These texts give names of people and places and explain briefly the depicted events. Most of these short texts are placed within the image area of each scene, but some are placed in the top border. The decorative borders above and below the main narrative story show associated events, animals, beasts, and scenes from agriculture, fables, and hunting. The embroidery has been partially restored and it may now contain portions that are not entirely faithful to the original material. This was almost 950 years ago.

Beauty. Philosophers have made many unsuccessful attempts to define beauty. In the 18th century philosophers agreed that beauty could not be defined in terms of the qualities shared by all beautiful objects. See *Alberti*.

Beck. The English engineering draughtsman Harry Beck (1902–1974) designed the radically simplified and not to scale topological map of the Underground tube system in London (1931). The new map was based on a map of the River Thames. Harry Beck considered the needs of the individual passengers to be able to easily plan their journeys, how to get from one station to another and where to change trains. He therefore prioritized function, simplicity, and usability over geographical accuracy. All subway lines were represented in different colours with horizontal, vertical, or diagonal lines. The stations were evenly distributed. Diamonds indicated interchange stations. The map was immediately popular.

Beneficial results. Information materials often consist of words. There is probably no other instructional device that leads to more consistently beneficial results than adding pictures to a verbal presentation, oral or written. There can be no doubt that pictures combined with words can produce strong facilitative effects on learning and retention.

Berling is a common serif typeface.

Bernini. Gianlorenzo Bernini (1598–1680) was the main Italian architect and sculptor during the Baroque period. He developed sculpture to a level that no one had seen before or since. The sculpture was often an integral part of the surrounding space. Bernini was a pioneer in the design of light, movement, volume, and even sound. He made his personal mark on an entire epoch. Bernini had up to 200 employees who carried out many of his projects. See *Baroque period, Light designer, Motion designer, Sound designer*.

Beta movement. The beta movement is an optical illusion. Fixed images seem to move. It is an apparent movement caused by luminous stationary impulses. The psychologist Max Wertheimer defined the beta movement in 1912. See *Phi phenomenon*.

Biblia Pauperum. From about 1250 *Biblia Pauperum* consisted of a collection of about 50 colourful hand-painted loose pages. These sheets were copied in many varieties. *Biblia pauperum* was often called the “bible of the poor.” However, these manuscripts were very expensive, and not intended to be bought by “economically poor” people, but maybe by people that were “poor in spirit.” In the 1460s printed copies of *Biblia Pauperum*, from Germany, were produced. Here both images and texts were cut entirely in one single wood block for each page. The text-face was about 25 x 18 cm. It is difficult to produce text in small fonts on a plate of wood and it is not possible to use thin lines in the pictures. All lines are usually quite rough. However, woodcuts became very important when the art of printing expanded. Printed 40 page block-book versions of *Biblia Pauperum* were far cheaper than the previous illuminated manuscripts.

Bibliography. References to cited works are usually put in a *reference list*, or a *bibliography*, at the end of a chapter or at the end of a book. Write references in accordance with one of the international conventions. Reference lists are often voluminous and may take up a great deal of space. Since the reader will usually peruse such a list to find only certain entries, they should be made easy to find. Therefore, the text should be distinct even though it is relatively compact.

Bird's-eye perspective, *bird's-eye view*, is a level perspective. Here an object is viewed from a high position. We may be looking down from a vantage point in a high building, on a mountain, or in an airplane. Bird's eye views have existed since classical times. In art, film, photography and video a person seen from this perspective look small, unimportant, and weak. Too high view of a person shows little convergence. This perspective is often used for blueprints, floor plans and maps. Sometimes the terms *aerial view* and *aerial viewpoint* are used for bird's-eye perspectives. The term *aerial view* can refer to any view from a great height, even at a wide angle. The bird's-eye perspective is the opposite of a *worm's-eye perspective*.

Bird's-eye view. See *Bird's-eye perspective*.

Bit-mapped image, or *pixel image*, consists of a large number of small pixels or picture elements, e.g., small squares. These pixels have either a colour (usually black, but they may also be e.g. green or blue, depending on the design of the screen) or no colour at all. All pixels have the same size. Bit-mapped graphics can be modified, stretched, condensed, inverted, rotated, and outlined. Paint-programs are effective multi-purpose drawing tools.

Black letter type style resembles old German manuscript handwriting. Black letter type is difficult to read and rarely used in the USA. Examples are Fraktur, Rotunda, Schwabacher, and Textura.

Blanquart-Evrard. The French photographer Louis-Désiré Blanquart-Evrard (1802–1872) was a pioneer in photography.

He published the Calotype process (1847) and developed the albumen silver paper print technique (1850).

Bleed is text and/or pictures that extend beyond the trim edge of the printed page.

BLIX is a *picture readability index* with values ranging from zero to five. A BLIX-5 picture: 1) is executed in a true-to-life colour/has a clear contrast and grey scale in the picture. 2) Has a shape other than a square or a rectangle or covers an entire page. 3) Has a caption which is brief, easy to understand, and deals with the picture. 4) Is unambiguous and not too “artistic.” 5) Has a dominant centre of interest at or near its optical centre (middle of the picture) and few details, which can be regarded as distracting. Picture readability is positively correlated with both aesthetic rating and usefulness in teaching.

Block book. The ability to print images on paper was achieved in Europe in the 14th century. It is a relief printing technique. The block book contained text that was written by hand but had printed images, coloured by hand. See *Early books*.

Block diagram is a schematic picture. See *Diagrams*.

Blowup. A blowup is an enlarged picture.

Bodoni. The Italian printer, publisher, type-designer, and typographer *Giambattista Bodoni* (1740–1813) designed the *Bodoni typeface* (1788) and no less than 297 other typefaces. In page layout he used several type sizes, wide margins, and few selected illustrations. Bodoni was called “The Kings book printer, and the book printers king.” For more than 200 hun-

dred years the Bodoni-style has been called “modern” or “modern type.”

Body art. Throughout the ages, people have adorned themselves with various decorations. Prehistoric hunters smeared their bodies with clay and earth to better blend into the landscape. Body painting, tattoo and scarification occur in all traditional tribal cultures. But body art pictures are obviously normally not preserved.

Body language. Our body language is partly instinctive, partly learned and imitative. Body language may account for half, or more, of all human communications. It may be more important than the words in an oral presentation. Enthusiasm of an instructor can stimulate positive motivation among listeners. A sensitive speaker can learn to use gestures, movements, facial expressions, and articulation for clarifying, enhancing, punctuating and underlining the vitality of words. Many gestures and movements can be interpreted without ambiguity in a given cultural community but not outside that community. See *Speech and body language*.

Body messages. The credibility of a speaker is influenced by her or his actual performance. Any message must always be in close agreement with the body language. An audience will believe what they see much more than what they hear. The choice of clothing can also convey fairly detailed information. This is especially the case for markers and symbols associated with particular groups of people. See *Speech and body language*.

Body paintings are temporary and often worn during ceremonies. These paintings are painted directly onto the human

skin. Body paintings may last from a few hours up to a couple of weeks. Some body paintings are limited to the face. See *Body art*.

Bold type, or *Boldface*, is a member of a family of type in which letters are heavy, **bold**. Bold type has been seen as aggressive, assertive, daring, difficult to read, domineering, masculine, overbearing, solid, stable, strong, substantial, and unprofessional.

Boldface. See *Bold type*.

Bonus information is information that catches our interest when we browse through a paper, an encyclopaedia, or a hypermedia system.

Book machines may be installed in bookstores throughout a country. The digital telecommunications networks make it possible to transfer all necessary data from central databases to any individual book machine. This may eliminate the need for physical distribution and warehousing of books. The development of Internet and the WWW has in fact made it possible for anyone to publish their own books.

Book of Hours were prayer books carefully adopted for individual use with selected and appropriate prayers for specific hours of the day, days of the week, months and seasons of the year. Usually these manuscripts had beautiful illustrations. The illustrations should help the reader to meditate on the subject of the prayers. Monks in monasteries had produced these books from the 13th century.

Book production. Book-making techniques have been successively improved, making it possible to print large runs of better quality in less time. Only the creative work of authors and illustrators remain about the same.

Books of the dead. The first “travel guides” were produced and sold as early as 4,000 years ago. The Egyptian “Books of the Dead” contained advice and information, in an integrated design with a verbal and visual amalgam of text and pictures on coping with the trip to the Kingdom of Death. *The Books of the Dead may be the first examples ever where text, pictures and graphic design really are integrated.* The Books of the Dead were completely hand-made rolls of papyrus and, thanks to their high price, only available to truly wealthy families.

Bookman is a common serif typeface.

Books, advantages and disadvantages. Books have major advantages, but also shortcomings. One advantage is size and convenience. Books can be used at virtually any time and place, without any special equipment or preparations. Readers do not have to give a thought to connecting cords, fuses, technical standards and voltage requirements etc., aspects that often complicate utilization of new media. One disadvantage is the relatively long time it takes to produce a book. Economic considerations usually comprise major restraints to factors such as illustrations. Books take up rather a lot of space and they are heavy to transport in volume. They also tend to be in the wrong place when you need them. The lack of moving pictures and sound could also be described as disadvantages of books.

Books, costs. The constantly rising cost of labour, materials, technical production, handling, warehousing and distribution has contributed to the introduction of new technology and new media.

Books, databases. When both text and pictures are stored in digital form in databases, direct production of printing plates for large printing runs is possible. However, modern copying equipment can be efficiently employed for smaller runs, e.g. a single chapter of a book.

Borders are ornamental rules around the edge of a page or a page component. See *Rules*.

Box. Text may be included in a box.

Especially important messages like summaries can be boxed-in to gain special attention. If the lines are shorter the effect is even more obvious. Boxes usually have thin lines. Boxes may sometimes be filled with a background colour.
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Boyd cycle. See *OODA-loop*.

Brain. The brain is arranged hierarchically. The higher region of the brain consists of the cerebral hemispheres, with such structures as the basal ganglia, the hippocampus, and the amygdala. The *basal ganglia* are involved in complex action sequences. The *hippocampus* is an important structure in memory and spatial behaviour. The *amygdala* is involved in the regulation of higher-order motivational states. The top layer of the brain is the *cerebral cortex*. This is the main region for complex thought and other intellectual functions. The cerebral

cortex contains sophisticated circuits for the processing of sensory information and the execution of movement. Different regions of the cerebral cortex have different functions. Vision is processed by the *occipital lobes* at the back of the head. Hearing is processed by the *temporal lobes* on each side of the head. The parietal lobes are important association regions that combine information from different sources. The frontal lobes are specialized for planning and execution of complex activities. See *Brain capacity, Brain halves, Brain research, Brain stem, Dual-coding memory model, Fantasy images, Forgetting, Long-term memory, Memory, Sensory memory, Short-term memory.*

Brain capacity. The brain has 100 billion brain cells (neurons) and 900 billion supporting glia cells. Each neuron may be connected to other brain cells via more than 20,000 structures called synapses. The brain cells communicate with each other by transmitting electrical impulses through this gigantic network, which is constantly changed and adopted to new situations. Many estimates have been made of brain capacity. It has been said that the number of possible connections between the brain cells are greater than the number of molecules in the universe.

Brain halves. In accordance with some theories, the two halves of the brain are apparently specialized and function independently of one another. At the same time, however, either of the brain halves appears to be capable of assuming the functions of the other half. There is an immense communication between the two halves of the brain. It has been estimated at six billion pulses per second. The left half of the brain is said to be

mainly verbal. It is capable of counting, speech, and writing. It is specialized in abstract thought. It is analytical, detailed, logical, and sequential. The right half of the brain is said to be speechless, but it is capable of concrete thought, perception of space, and it can understand complicated relationships. It is also said to be creative holistic, intuitive, and spatial.

Brain research. The modern era of brain research began in the mid 1960's, when Dr. Roger Sperry and his associates published their findings regarding patients who were operated on to control life-threatening epileptic seizures. All predictions that our brain cells have been decaying from the moment we were born have been refuted. Research suggests that brain cells can regenerate and that nerve cells certainly can grow again.

Brain stem is the lower region of the brain. It consists of four parts: the medulla oblongata, the pons, the cerebellum and the midbrain. The *medulla oblongata* regulates autonomic functions, such as control of movements and breathing. The *pons* contains circuits for basic movements. The *cerebellum* regulates the fine control of timing in movement and perception. The *midbrain* is involved with sensory and motor integration. See *Brain*.

Brief messages is a term for a category of information materials that includes *Simple instructions*, *Prohibitions*, *Information*, and *Warnings*. Brief Messages may be carried by acoustic signals, body language, combined acoustic and optical signals, graphic symbols, instrument panels, instrument windows, olfactory signals, optical signals, planning boards, prohibition texts, prose, sensory signals, signal lamps, signal texts, symbols,

and warning texts. Information can be impressed or printed on different products, such as machinery and signs, in the form of words, letters or symbols. Much useful information is supplied in traffic, e.g. on route signs. Other examples are emergency signals, such as flares or signal rockets from ships in distress or hikers who get lost or injured.

Brightness is the experienced intensity of light (bright-dull). In colour displays it is very difficult to distinguish brightness from lightness (white-black). When the signal to a colour display is increased, the brightness of the total screen is increased.

Brinton. The US engineer Willard Cope Brinton (1882–1945) was a pioneer in visualizing numeric data. He designed and wrote the book *Graphic methods for presenting facts* (1914). This was the first book about graphic design aimed for business and a general audience. Brinton published the book *Graphic Presentation* himself (1939). This book is a detailed guide for everyone who wants to visualize numeric data.

Broadcast media are media distributed to groups of people through the ‘ether’, e.g. national radio, local radio, community radio, cell radio, CB radio, national TV, local TV, community TV and text TV. Mobile telephony also belongs to this category.

Broca’s area is an anterior zone in the left frontal cortex. The functions regulate articulation of speech. See *Speech*.

Brochure. A brochure is a booklet, usually twelve pages or more.

Browse. See *Bonus information, Navigation*.

Brunelleschi. See *Filippo Brunelleschi*.

Bubble chart is a schematic picture. See *Diagrams*.

Bullets (•) are commonly used in lists of items in “point form” without numbers. Bullets are more powerful than *hyphens (-)* and *asterisks (*)*.

Business documents is a term for a group of information materials in the category *Administrative documentation*.

C

C series paper. The *C series* is used only for envelopes. The area of a C series sheet is the geometric mean of the areas of the A and B series sheets with the same numbers. A letter that is written on A4 paper fits inside an envelope in size C4. Size C= (C zero) is 917×1297 mm, C1 648×917 , C2 458×648 , C3 324×458 , C4 229×324 , C5 162×229 , C6 114×162 , C7 81×114 , C8 57×81 , C9 40×57 , and C10 28×40 mm.

CAD, computer-aided design. See *Technical visualization*.

CAI, *Computer-aided instruction*, is a kind of E-learning. See *E-learning*.

Camera angle is a variable that will influence our perception of individuals in photographs. An individual appears powerful if he or she is photographed from below with the photographer looking up at the subject. An individual appears less powerful if he or she is photographed from above.

Camera placement is a variable that will influence our perception of individuals in photographs. Photographs showing a subject straight on are more positive than those showing a subject from the side and much more positive than those showing a person from behind.

Camera-ready is the term for a final printout of a page with text and pictures that is ready for reproduction, and also for art that is ready for reproduction.

Camouflage. The objective in military camouflage is to hide positions, troops, weapons, and vehicles in the background,

from the eye of the enemy. As a result of considerable research military camouflage on land, at sea and in the air developed rapidly in the 20th century. Thus camouflage is the opposite to information design, it is *disinformation design*.

Cap height, *height*, or *H-height*, is the size of capital letters in a typeface, expressed as a percentage of the point size. See *x-height*.

Cap-line, a horizontal imaginary line, at the top of capital letters in a typeface. See *x-height*.

Capacity theory. We are not able to attend to more than one stimulus at a time. Attention is a limited capacity channel that determines the serial processing of the perceptual system. Content of an unattended message may be perceived if it is relevant.

Capital letters, or *caps*, are harder to read than a combination of upper and lower case letters. Without sufficient white space around words in all capitals, the words will become too difficult to read. In most situations, text should contain a mixture of upper and lower case letters.

Capitalisation. Internationally, there are several conventions for how to capitalise titles, chapter headings, section headings, and concepts in body text. The conventions differ between the USA and Britain. They also differ within each country, between different publishing firms and between companies.

Caps, short form for *Capital letters*.

Caption. Always write captions to explain the intended meaning of pictures. It is possible to interpret most pictures in sev-

eral different ways until they are "anchored" to one interpretation by a caption, or *legend*. See *Caption content*, *Caption form*, *Caption heading*, *Caption placement*, *Caption typography*.

Caption content. Captions heavily influence our interpretation of image content. In information design the main function of captions is to help the reader select and read the intended content in the picture. We need to tell the readers what we want them to see and learn from each illustration. Photographs nearly always need a partnership with words that will clarify, confirm, and reinforce their messages.

Caption form. A caption should be edited to fit different reader categories, such as general readers (children, teenagers, adults), technical readers, and specialist readers. A printed photo is, in fact, past tense. However, when an activity must be explained, present tense and active verbs are appropriate. The caption should be brief and easy to understand.

Caption heading. A caption can have a short and distinct heading. This is an additional link between the picture, the caption, and the main text. Quite often one word is enough.

Caption placement. A caption may be placed in many ways, but always close to the picture. Readers usually expect to find the captions beneath the pictures. However, captions can also be placed above, to the left, or to the right, of the picture, but never inside the picture frame.

Caption typography. The caption should have a different typographic size or even a different typeface so it can be easily distinguished from the main text. The captions should not be in

negative form in a colour picture since the slightest misalignment in printing makes the captions extremely difficult to read. Never make the caption type larger than the main text. The title of the caption could be printed in boldface.

Captured images. See *Image morphology*.

Cartoon is a schematic picture. See *Drawings*.

Cartoon style is a pictorial artistic style, an animated caricature of the subject.

Carved figures. Ever since the Stone Age, artists have used other people as their noblest motives for artistic representations of various kinds. The female images in bone, ivory, stone, and wood show the Palaeolithic hunter's concern with fertility. During the 1900s, several archaeologists have found many female statuettes in various parts of Eurasia. These female images are collectively referred to as "Venus figurines." Other common motifs are small animal figures, which perhaps gave the hunter-gatherer peoples hopeful of good hunting.

Caslon is a common serif typeface, created in England by William Caslon in 1734.

Cast shadow. See *Shadows*.

Cathode ray tube, CRT. See *Picture tube*.

CAVE (Cave Automatic Virtual Environment) is a virtual reality system, a multi-person, room-sized, high-resolution, 3D video and audio environment. Inside a 10x10x9 foot theatre people use lightweight stereo glasses. Viewers may be completely sur-

rounded by 3D computer graphics projected in stereo onto several or all walls, the roof, and the floor.

CBI, *Computer-based instruction*. See *E-learning*.

CBT, *Computer-based training*. See *E-learning*.

CCD, Charge Coupled Device. See CCD-technology, Desktop scanner.

CCD-technology. A CCD-cell consists of a number of light sensitive crystals that can transform light into digital codes.

CD-I, Compact Disc Interactive, is a CD disc capable of holding audio, images, text, and data. CD-I can store 10,000 hours of “synthetic sound,” 384 hours of natural speech, 40,000 line drawings, 4,000 “TV quality” colour frames or various combinations thereof. CD-I was announced in February 1986 and has been for sale since 1990

CD-ROM, Compact Disc-Read Only Memory, is a CD disc for the storage of data (540–600 MB). It was announced in August 1983 and went on sale in the U.S. in 1985. One CD-ROM is capable of storing the text in several large encyclopaedias, making this information available as a free-text database. Its capacity is equivalent to about 250,000 pages of typewritten text.

Central perspective, *one-point perspective*, or *Renaissance perspective* is a *Line perspective*. In a central perspective, lines in the picture converge at a common point of intersection—the limit or main point—even though they are parallel in reality. Central perspective is a “one-point perspective.” All lines vanish in a single point in the picture. See *Bird's-eye perspective*, *Eye-*

level perspective, Gentleman's perspective, Line-based positional perspectives, Military perspective, and Worm's-eye perspective.

Centre justified texts are centred in the column. Symmetrical centre justified texts may be seen as formal, grave and momentous. They may be used for menus, poetry, short captions and tables of contents. In films and in television programs the participants are usually listed centre justified.

Centres of interest. A visual should only have a few centres of interest, preferably only one at or near its optical centre just above and to the left of its geometric centre or otherwise in the upper third of the visual. The centre of interest should be immediately apparent. Thus the visual has unity. According to the “rule of thirds” the centre of interest may be selected at any one of the four points where two equidistant vertical and two horizontal lines divide a picture in a total of nine parts.

Century Old Style is a classical newspaper serif typeface.

Cerebellum in the brain stem, the lower region of the brain, regulates the fine control of timing in movement and perception.

Cerebral cortex is the top layer of the brain. This is the main region for complex thought and other intellectual functions. The cerebral cortex contains sophisticated circuits for the processing of sensory information and the execution of movement. Different regions of the cerebral cortex have different functions.

Chalk talk. Many teachers spend most of their time in the classrooms talking to their classes. Teaching is very much

“chalk talk.” It appears that teachers generally teach the way they were taught, following the traditional approach to education, providing pre-packaged information to students. Frequent types of illustrations are words, tables, and formulas, followed by diagrams and graphs. On average, pictorial images are not used often.

Changing scale. Pictures should always be adjusted to fit into their final context. A picture can be enlarged or reduced in the same proportions as the original if the new dimensions meet at the diagonal of the original. There is an optimum size for each visual. The content remains the same but the chosen scale can influence our perception of it. The original width (w_1) divided by the original height (h_1) is the same as the reproduction width (w_2) divided by the reproduction height (h_2). $w_1/h_1 = w_2/h_2$.

Character. The properties of characters, *letters*, are limited. A letter has a given position in an alphabet. It has a name. It is represented by one or more sounds and is used in a specific context.

Character index offers more thorough information about a text than the readability index. Each sentence is analysed and noted on a chart. The y-axis represents the number of long words and the x-axis the number of words per sentence. Long words and long sentences make a text difficult to read.

Chauvet Cave. The prehistoric cave paintings illustrated early man’s observations of the world around him. The images in the *Chauvet Cave* in southern France belong to the oldest in Europe. They are approximately 32,000 years old. The cave has

200–300 painted or carved animal figures, such as bison, horses, and rhinos.

Check box. Check boxes (☐) can be used in instructional materials when learners may make check marks when they have finished assignments.

Chéret. The multi-talented Jules Chéret (1836–1932) was a French artist, decorator, lithographer and painter. After a seven-year-long stay in London he returned to France bringing modern English printing equipments with him. Chéret developed the lithographic multi-colour technology. At a very low cost he printed up to 10,000 posters per hour. From 1866 Chéret created artistic posters advertising a wide range of everyday products. He developed a unique, playful, and pleasurable style by connecting the text to the picture in a new way. Chéret concentrated the message in a big, central comprehensive picture, in order to accomplish maximal effect and visual impact. He became a major advertising force, and he is often called both “the father of modern advertising” and “the father of the poster.” Jules Chéret produced about 1,200 posters.

Chichén Itza. The old cultures and civilizations in Mesoamerica used advanced pictorial messages, especially in their temple cities. A temple for the god Kukulcan was built on a square platform on top of the big pyramid in Chichén Itza. The temple, El Castillo, (the castle) was completed about 830 AD. The pyramid is actually a huge calendar, rising 21 meters above the jungle floor. Up to 40,000 people gather on the ground in front of the pyramid at the vernal Equinox (March 21) and at the autumnal Equinox (September 21). People want to experi-

ence a remarkable phenomenon, a “story” produced by light and shadow on the pyramid. These days the light from the dying sun casts shadows from the terraces in such a way that an illuminated image of a snake appears on the northern staircase. Thus, during the hours before sunset “the feathered serpent” appears to move, slither and wriggle from its temple at the top of the pyramid and down to the ground. To the Mayans, this represented their god coming down to reward his loyal followers and to ensure a good harvest.

Chief Experience Officer, CXO, is the person that is responsible for the design of an organisation’s user interface, and how their intended audience will experience the organization. See *User experience*.

Chief Information Officer, CIO, is the most significant addition to the executive room as a result of the information age. In many companies the CIO is technically oriented rather the human-centric. However, a CIO needs to know more of leadership and management than technology. The major concern today is information assurance. See *Information assurance*.

Chop-mark. A Chop-mark is a symbol of a printer specializing in printing of fine arts, such as etchings.

Chroma is usually called *colour*. See *Saturation*.

Chromatic colours are blue, green, red and yellow. See *Natural Colour System*.

Churches. Medieval cathedrals had great splendor. They have been called “theological encyclopedias,” because they presented church teachings in pictorial form for the many people who

could not read. At the beginning of the 7th century pope Gregorius the Great (about 540–604) had said that pictures are used in churches so that those who cannot read at least can look at the walls and understand what they cannot read in books. Gregorius the Great presented his insights and views in a new and simple manner.

Cinema-U is a modification of OMAX, has one of the world's largest cinema screens 23 x 16 m, 368 m² (1:1.44).

CinemaScope is a system for wide-film first used in 1953. CinemaScope uses a special camera in which the “anamorph” optics “crowds” the image from the sides so that it fits onto a normal 35-mm film. When projecting the film a special projector “spreads out” the image again. The projected picture has the height-width relationship of 1:2,35. The screen is slightly curved to get the whole picture in focus. In the middle of the screen the resolution is 200 pixels per square inch.

Cinerama is a system for wide-film first used in 1952. Cinerama uses three separate 35-mm films simultaneously. Three different cameras carefully put together record these. The films are projected on a wide, curved screen by three projectors. The viewers' angle is 70-80 degrees compared to 40 degrees for 35-mm film. Cinerama uses many speakers and stereo sound. Cinerama films often show car hunts and dangerous rides in airplanes, helicopters, boats, trains and the like. The result is often very suggestive.

CIO. *Chief Information Officer.*

Circle chart is a diagram with comparison of areas. See *Diagrams*.

Circle chart map is a schematic picture. See *Maps*.

Circle graph is a schematic picture. See *Pie charts, Playfair*.

Circuit diagram is a schematic picture. See *Diagrams*.

Circulation diagram is a schematic picture. See *Diagrams*.

Circulation is a schematic picture. See *Metaphorical pictures*.

Citation. A citation is a quotation from or a reference to a published source like a book or a paper, but also to an unpublished source.

Clarity. Providing clarity in text, illustrations, and graphic form is fairly easy because it is determined by the technical design. Information materials should be as clear, simple, transparent and unambiguous as possible. Structure the text and try to be as clear as possible. Avoid strange and foreign words. Express one idea per sentence. Keep to a simple word order and avoid long-winded expressions. Avoid unusual typefaces, as well as fonts that are too small or too large. Adapt typeface and font size to meet the limitations of the medium and the technical production. See *Legibility*.

Classical conditioning. In classical conditioning an organism learns that one event follows another. The Russian physiologist Ivan Pavlov found that his dogs tended to give the same conditioned response to different stimuli. Classical conditioning helps to explain children's and adults' strong positive and negative attitudes, feelings, and emotions toward school and teach-

ers. Many commercials for alcohol, cars, cigarettes, and perfume employ the classic “sex appeal,” so that the product is paired with a stimulating male or female.

Classical formats are based on the proportions of the golden section or golden rectangle, 3:5, 5:8, 8:13, 13:21, 21:34, etc. The proportions of the golden section are 1:1.618

Classification of information materials is based on the main objectives for information materials. 1) Advertising and propaganda. 2) Informative entertainment. 3) Brief messages (with Simple instructions, Prohibitions, Information, Warnings). 4) Administrative documentation (with Working materials, Administrative messages, Business documents). 5) Factual information (with Facts, Descriptions, Reports). 6) Instructions (with Directions for use, Production and maintenance documentation, Good advice, Interfaces, Recipes, Guidance), and 7) Teaching aids. (However, some information materials simultaneously contain more than one kind of information message.)

Classification of representations. I distinguish between two main categories of representations, I) Figurative representations, and II) Non-figurative representations. The category figurative representations include two groups: 1) Visuals, and 2) Graphic symbols. Visuals include four subgroups 1) Three-dimensional images, 2) Photographs, 3) Realistic drawings, and 4) Schematic drawings. Graphic symbols include three subgroups 1) Pictorial symbols, 2) Abstract symbols, and 3) Arbitrary symbols. The category non-figurative representations include two groups, 1) Verbal symbols, and 2) Non-visual and non-verbal representations. The group verbal symbols include

three subgroups 1) Verbal descriptions, 2) Nouns or labels, and 3) Letters and characters. The group non-visual and non-verbal representations include two subgroups 1) Sounds, and 2) Odours and scents.

Classification of visuals. Visuals can be classified according to various criteria, such as content, context, execution, format, function, means of production, receiver, and sender. With reference to the distance to and the size of the motif, photographers may classify pictures as long shots, full-length portraits, half-length portraits, and close-ups.

Clear. Put yourself in your readers' situation. Structure the text and try to be as clear as possible. Avoid strange and foreign words. Express one idea per sentence. Keep to a simple word order and avoid long-winded expressions.

Clear objectives. Several researchers have pointed out that it is always important to define clear objectives in message design or in instruction design, as well as in information design.

Clear structure. A clear and obvious structure will facilitate perception, interpretation, understanding, learning and memory of the information content. Layout and typographic variation provides a large number of possibilities to make the structure clear.

Clip art refers to pre-made images used for illustrations in any medium. Today clip art is often available in computer software. It does not include stock photography.

Cloropleth is a schematic picture. See *Maps*.

Close context is an external context, such as the lighting in a room when we read a book or view projected images. See *Context perspective*.

Closure principle is also known as the *law of closure*, *natural law*, and *theory of closure*. This principle is based on our tendency to see complete figures even when the stimuli is incomplete. When a figure, letter, picture, shape, or symbol is incomplete, and parts of its border are missing, our minds will automatically fill in the missing parts and “close” the outline of the structure. See *Perception “laws.”*

Clustered bar is a schematic picture. See *Bar charts*.

Cognition is a mental processing model used in cognitive psychology. It establishes that our working memory is limited to five to seven “chunks” of information. Our attention must frequently be refreshed, and recalling information requires more cognitive effort than recognizing information. We see, hear, and taste cohesive and unified information. Touch panels in information kiosks and graphic displays in most video games overcome many psychological limitations. They share the “load” between physical and cognitive activity. Immediate feedback and easily reversibility invite user exploration.

Cognitive apprenticeship. Traditionally people have learned to speak, learned their crafts, and to use tools by observing and imitating parents and masters. When we watch someone carrying out a skill the performance appears to be automatic, confident, consistent, easy, effective, efficient, fast, and smooth. When problems arose apprentices understood the reasons for the problems in a natural way. They asked the necessary ques-

tions, and imitated the observed steps to solve the problems. Apprentices acquired their skills through a combination of observation, coaching, and practice. Now cognitive apprenticeship focuses specifically on cognitive and meta-cognitive skills. Media can function as powerful tools within a cognitive apprenticeship model, by facilitating the construction of knowledge through the provision of mediated contexts.

Cognitive development takes place along with remarkable neurological, physical, and perceptual changes during the first years of life. What learning is and how it develops is a primary concern for scientists interested in human development. Children of all ages recognise visual stimuli better than auditory stimuli. Learner characteristics, such as age, gender, culture, prior knowledge of the subject matter, scanning habits, and visual and text processing abilities affect learning abilities and learning skills.

Cognitive levels. Perception and thinking are activities that take place where no one can see them — inside our heads. Because thinking is hidden we can only infer its existence from people's behaviour. When we think, we classify, combine and manipulate internal information. When we are through, we know something that we did not know before. Much of our thinking involves verbal language. We use concepts and words, but we also think in images and shapes.

Cognitive load, the amount of mental demand on working memory at a given moment.

Cognitive principles denote one of the four groups of message design principles; *facilitating attention, facilitating per-*

ception, facilitating processing, and facilitating memory. Guidelines based on these principles will assist the information designer to design information and learning materials that are well suited for the intended receivers. How we actually create meaning is an area where a lot of research is still needed. Complicated language, in both texts, pictures and graphic form will impair the understanding of any intended message. Information materials providing the wrong information may actually give a negative result, and the receiver may end up less competent than before. See *Facilitating attention, Facilitating perception, Facilitating processing, Facilitating memory, and Message design principles.*

Cognitive resources. All cognitive tasks place demands on a pool of limited cognitive resources. When a task imposes a heavy load on the cognitive system, it will in turn interfere with learning by misdirecting attention and limiting remaining resources that are necessary for construction of knowledge. Resource models based on individually allocated pools of resources have been developed to explain the effects of structural alteration and time sharing that can not be effectively explained by other attention models such as structural theories, and capacity theories.

Cognitive science, the multidisciplinary scientific study of the mind and its processes. It examines *cognition*.

Cognitive style describes the learner's typical modes of perceiving, thinking, problem solving, and remembering of information. This term has often been used interchangeably with *learning style*, the affective, cognitive, and physiological traits

that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment.

Cognitive use of colour. For some learners and for some educational objectives, colour improves the achievement of the learners. However, in some cases the added cost of colour will not be justified. Colour is important in a visual when it carries information that is vital to the contents in the visual.

Colon (:) tells the readers that what follows is closely related to the preceding clause: 1) A list will follow. 2) Further information is to follow. 3) Introducing an example of what was said in the first part of a sentence.

Collaborators in learning. When students work together they take part in a cooperative learning process. Here the dialogue is primarily between students, not with the teacher or with the teaching material. However, some dialogue with the teacher is desirable to secure understanding of the subject matter content. Faculty members can assist in building well-structured, resource-based learning environments.

Colour is regularly used in printed materials, not only in illustrations, but also in the text itself. Colour can be used to clarify the structure of the text and to make learning easier. When we talk about the colour of an object we usually refer to the hue of that object. Most people are familiar with hue through our labelling of colours such as red, orange, yellow, green, blue, and violet. There are strong cultural differences in interpreting the meanings of colour. See *Affective use of colour*, *Anomalies of colour vision*, *Cognitive use of colour*, *Colour and advertising*, *Colour and associations*, *Colour as decoration*,

Colour Colour coding, Colour description systems, Colour in pictures, Colour perception, Colour perspective, Colour preferences, Colour spacing, Colour use, Natural Colour System, and Text colour.

Colour and advertising. Advertising is known to be much more effective when visuals are in colour than in black and white.

Colour and associations. Yellow, orange, and red hues are perceived as warm and active. Red evokes feelings of strong emotions. Violet, blue, and blue-green are perceived as cool and passive hues. Blue is often used to represent truth and honesty. White is often associated with innocence and pureness, and black often represents evil and darkness.

Colour and emotions. In the western cultural sphere, people tend to associate colours with emotions or moods in the following way. The red and yellow part of the spectrum is often said to be warm and is felt to be active, exciting, happy, and clear. Green to blue are described as cold and are perceived as being passive, comfortable, controlled, and peaceful. See *Emotions*.

Colour and shape. Children are better at identifying objects by their shape than by their colour. Experiments showed that there was no natural, and unambiguous correlation between colour and shape, and not between shape and colour.

Colour and text. See *Text colour*.

Colour as decoration. There are many situations where colour and typographic elements can be used for decoration. However, a decorative use of colour or typography should never be

mixed with an intended use to provide a clear structure, simplicity and hierarchy. It must always be clear, and easy to understand for the receiver when colour is used for decoration and when the use is meant to have some cognitive importance.

Colour as language. Colour is regularly used in printed materials, not only in illustrations, but also in the text itself. Colour can be used to clarify the structure of the text and to make learning easier. Certain parts of the text may be printed with colours or printed on top of backgrounds in different colours. Here colour carry meaning.

Colour blindness. See *Anomalies of colour vision*.

Colour Bubble-Jet Printers. Each of four high-density bubble-jet print heads has 128 vertically arranged nozzles. Digitally stored images can be printed in full colour with a vertical and horizontal resolution of 400 dots per inch. The maximum image width is 472 mm. Plain paper, in 50 metre rolls, is used. It is possible to use four out of seven colours (black, red, green, blue, yellow, magenta, and cyan). All ink dots have the same size, and the number of dots within an area can be altered. Many dots create dark tones and few dots create light tones. Each nozzle has a heater. When the heater operates the heat produces small bubbles. Ink evaporates abruptly and the bubbles inflate. After cooling, each bubble contracts. The ink splashes out of the nozzle and the bubbles disappear. A colour bubble-jet printer can be used e.g. as a terminal for computer graphics, or for simulations of colour plate making in the printing industry. The print speed is 2,000 dots per second per nozzle. This means that

1,024,000 colour bubbles can be produced every second. A colour picture in A2 format is printed in 8 minutes.

Colour circle. See *Natural Colour System*.

Colour coding is a good way to show that something is especially important and interesting. It can be used to improve attention in documents, in signs and in symbols and increase learning. However, the number of colour codes must be limited and they should always be explained. To avoid confusion and misunderstanding, it is important that colour be used consistently. Inconsistent and improper use of colour can be distracting, fatiguing, and upsetting, and it can actually produce negative results and reduce learning.

Colour combination. When text is shown on a visual display, there is no easily read colour combination. Rather than focusing on specific colours as always best, designers should work to ensure good contrast between text and background.

Colour constancy is our tendency to judge colours as the same despite changes in distance, viewing angle, and illumination. See *Perceptual constancy*.

Colour description systems. Colour can be described in aesthetic, physical, physiological, psychological, and technical terms. Hue, value, and saturation describe what we see. Intensity, purity and wavelength are physical dimensions. The relationship between brightness, hue, lightness and saturation is very complicated. For practical use in art and in industry several different systems providing numerical indexes for colour have been developed. See *Hue Lightness Saturation System*, *Hue*

Value Saturation System, Munsell Colour System, Natural Colour System, Tri-chromatic colour vision system.

Colour displays. Colour primaries are the basic colour stimuli used for the synthesis of any colour, by addition or subtraction. Additive combinations of a very limited amount of radiation are used for colour synthesis of a range of colours in a cathode ray tube (CRT) and in a visual display unit (VDU). Red, green, and blue are called the “three primaries,” RGB. Any two primary colours may be mixed to produce other colours. Advanced systems are capable of producing up to 256 simultaneously visible colour stimuli chosen from a palette of 16 million.

Colour in pictures. From many experiments, it is clear that people prefer colour in visuals. Colour enhances the attention and perception of a visual message. If people like the contents in a picture, they like them even more when the visual is presented in colour.

Colour key is a process for obtaining process colours on film by exposure to light.

Colour laser copier. In a colour laser copier a scanner “reads” the original picture and converts it into digital signals. The scanning resolution is often 400 dots per inch. The scanner reads the image four times, for magenta, yellow, cyan, and black. Then the digital information about the image can be processed and transmitted to the laser printer for production of colour copies. The picture elements form 8 x 8 pixel raster-dots. Each pixel may be printed with magenta, yellow, cyan, or black, or with combinations of those. In this case the printed copies can have 64 gradations per colour. A pixel can also be non-

printed and thus have the colour of the paper. Here the print resolution is 400 dots per inch. Since the image is handled in digital form, it can be edited in many ways. For example, the image may be reduced, enlarged, stretched, or slanted. Individual colours can be changed. A projector can be used for making full-colour copies from 35mm slides—even negative film.

Colour naming. All over the world people distinguish between black and white (or light and dark). Some cultures have names for three, four, five, or six colours, in this order: 1) White. 2) Black. 3) Red. 4) Yellow. 5) Green. 6) Blue. 7) Brown. Different cultures have developed highly specialized colour names for their specific environments and societies. Hunting societies in arctic areas had a large number of names for the colour of ice and snow and the Comanche Indians had no less than seventeen different designations for the colours of a horse.

Colour perception. It is possible for us to see the difference between several million colours. We can distinguish about 10,000 different colours, and only about seven colours in the same field of view. Yellow-green is in the region of the eye's greatest sensitivity. Our sensitivity decreases markedly toward the red and blue ends of the spectrum. Perception of colour is strongly influenced by and dependent on contextual variables such as lighting conditions and other surrounding colours. Considerable evidence suggests that perception of these factors differ depending on latitude. A black and white picture represents reality in a different way than colour pictures. In black and white, all colour are translated into values of grey. See *Vision*.

Colour perspective. Colours gradually change from being clear in the picture's foreground into being blurred in its background. Warm-coloured objects appear closer to the viewer than cool-coloured objects. A red or orange object against a green or blue background will have a sense of depth.

Colour preferences. Subjects prefer surface colours in this order: 1) Blue. 2) Red. 3) Green. 4) Violet. 5) Orange, and 6) Yellow. However, blue, red, and green do not improve our possibility of reading the message accurately. Colour intensity should be strong and colour contrast should be clear. Children prefer distinct, light, and shining colours better than dark and gloomy ones. Subjects dislike the use of more than three or four text colours on the same page, screen, or slide. When text is shown on a visual display, there is no easily read colour combination. Rather than focusing on specific colours as always best, designers should work to ensure good contrast between text and background.

Colour saturation influences our perception of shapes and objects. When colours of equal intensity are compared, the most visible hues are white, yellow, and green—in that order. The least visible hues are red, blue, and violet. Yellow is a powerful colour because of its luminosity. It is especially powerful when combined with black. Red is often seen as aggressive. In information graphics and statistical presentations, the most important elements should have the brightest colours, with the best contrasts to the background.

Colour spacing. Positioning letters so that balances of negative and positive spaces are pleasing.

Colour triangle. See *Natural Colour System*.

Colour use. People in different cultures and in different socio-economic groups use colours in different ways and with different meanings. In cultures in Africa, Central and South America, and Indonesia, bright colours and high contrast are common in illustrations. Tests have indicated that viewers feel that they have a better understanding when television images are displayed in colour, although the use of black and white sometimes would be sufficient. However, an improper use of colour can produce negative results; it can be distracting, fatiguing, and upsetting.

Colour-shape experiment. When subjects were asked to “draw the shape you feel best matches the respective name of a colour” the results clearly showed that there was no natural, spontaneous, and unambiguous correlation between colour and shape. The study also showed that there is no real difference between boys and girls, regarding associations between colour and shape. See *Shape-colour experiment*.

Column. A column is a vertical segment of a printed page.

Column chart is a schematic picture. See *Bar charts*.

Column rules are vertical lines between two columns.

Combined disciplines. Architecture, dance, economics, education, engineering, fine arts, journalism, medicine, music and theatre, and also information design are all examples of disciplines that have a practical as well as a theoretical component. When studying such a “combined discipline” it is important for the students involved to work both with practical as well as

theoretical aspects. Thus we need practical assignments. We may view such an academic discipline as a “theoretical practice” or as a “practical theory.” All combined disciplines are complex areas to research and to study. Adding a theoretical view to the practice of design is to reflect on the aims, methods and the results of this practice. In order to perform qualified and sound reflections we need concepts both to structure thoughts and to describe them verbally. And in order to do that we need to meet with other researchers who are interested in working on the same or in similar research areas and issues and engage in discussions. See *Infodidactics, Infography, Infology*.

Combined language. Texts and pictures represent different languages that complement each other when they are used at the same time. Both can be designed, presented, perceived and interpreted in many different ways. The possibilities for using typography and layout, and for combining texts and pictures are virtually unlimited. The interplay between text, picture, and graphic form needs to be studied thoroughly before optimal combinations can be found. There are always several opportunities to convey a message. See *Graphically complex texts, Captions*.

Combined learning

A large number of learning theories provide broad views of learning. Attention, perception, processing, and application are the basis for combined learning and the mental model of learning that I call the “Learning Helix.” See *Learning Helix*.

Combined verbal and numerical semantic scale is a good tool for ratings of intended and perceived image contents.

Verbal ratings are supplemented with a numerical scale from zero to one hundred: very poor (10), rather poor (30), neither poor nor good (50), rather good (70), and very good (90). So it is possible to be worse than very poor, and better than very good.

Combined verbal and visual messages. Learners are most able to build connections between verbal and visual representations when text and illustrations are actively held in memory at the same time. This can happen when text and illustrations are presented in close connection on the same page in a book, or when learners have sufficient experience to generate their own mental images as they read the text. Most pictures are capable of several interpretations until anchored to one by a caption. To a large degree readers see what they are told to see in an image.

Comenius. The bishop Jan Amos Komenský, or Latinized Iohannes Amos Comenius (1592–1670) of Moravia (later a part of Czechoslovakia) was the first person to really show to a broader audience how visuals and words could interplay in an active way. He presented the goal of education as the development of universal knowledge among all people, including women and children, and all nations. His conclusion, that nonverbal communication between parent and child both precedes and forms the basis of later language acquisition and development, is still considered a sound tenet of the theory of visual language. He was the first to introduce pictorial textbooks in education. Comenius was a pioneer in information design. See *Orbis Sensualium Pictus*.

Comic Sans. This typeface was designed for Microsoft based on lettering from comic books, but it has been used in many other situations. Comic Sans has been seen as breezy, fun, lazy, silly, and vulgar.

Comic strip sequence is schematic pictures. See *Drawings*.

Comma (,) can help the readers pick out the intended meaning easily. Use commas to avoid ambiguity.

Commodity. Information is merchandise, however different from other kinds of commodities. When transferred from sender to receiver it remains available to both. Unlike the sale of a material product, like a car, information transfer does not give the receiver the right of exclusive use.

Common fate principle is also known as the *law of common fate*. In accordance with this principle elements or objects that *move* in the same direction belong together and they are perceived as a collective entity. We perceptually group lines that seem to be moving in the same direction. This is common in diagrams and in graphs. See *Perception “laws.”*

Common region principle is also known as the *principle of closed forms*, and as the *principle of boundary*. We have a tendency to see elements or units that are enclosed by a boundary, such as a circle, as single units, all other things being equal. We group such elements together. Because of the *principle of common region* any kind of lines around an area or an object makes it stand out from the background.

Common typefaces. A “good” typeface might actually be one that is more or less “invisible” to us as readers. The typefaces in

common use are all more or less equally legible. Thousands of fonts are available. In the practical work with graphic design for information, we need only a few typefaces in different versions. Four examples are Georgia, Helvetica, Times New Roman, and Verdana.

Communication entails interplay between two or more persons. Aspects of our society are becoming increasingly intertwined, and the need for communication between people is increasing at a fast pace. If communication is to be possible at all, signals in some form must be produced, transmitted, received, and deciphered.

Communication design may be seen as the effective presentation of ideas in any media. It examines the role of the designer as a strategic architect/visual translator in producing language systems that focus on appropriateness, meaning, and the intended end user. Communication can be judged successful only when it conveys the information it sets out to convey. See *Information design genus*.

Communication disciplines include communication theory, education technology, information design, information technology, information theory, instructional design, instructional message design, instructional technology, journalism, media studies, persuasion design, planned communication, television and video.

Communication models. Many information and communication theorists have devised models to explain the way the communications process operates. Several activities are involved when an intended message is communicated from a

sender to a receiver, and received as an internalized message. These processes are guided by principle, performed with the help of tools and influenced by the social context.

Competence areas. In a large project there may be a need for many different skills, such as a project manager, a subject matter manager, a project secretary, a number of sub-project leaders, subject matter experts, technical writers, technical editors, translators, information brokers, graphics editors, photographers, illustrators, fine art artists, subject matter reviewers, linguistic consultants, terminology experts, pedagogues, graphic designers and web-masters. In a small project it is usually not possible to employ a large number of experts. However, also in small projects we need to organise various reviews.

Complete communication. All information materials must be legible and readable. They should also be well worth reading for members of the intended audience. The information designer should not view communication as complete until the intended audience understand the messages.

Complex matrices is a kind of matrix. See *Matrices*.

Complexity. A visual should usually possess a selected degree of complexity. Too little or too much complexity in a visual can interfere with the communication and learning processes. Too much complexity reduces the interest for the content in the visual. Too little complexity makes it impossible to understand the picture. See *Structural complexity*.

Composition can be defined as putting various elements in position according to aesthetic principles. It concerns the whole

gestalt of the information and the relationship between elements. See *Balance in pictures, Centres of interest*.

Comprehensibility in a text depends on abstraction, complexity, context, perspective, and redundancy. A message is comprehensible if the receiver can grasp it without difficulty.

Comprehensible language. Accidents occur and products break down because of poor quality of the complicated language in instruction manuals. As a result people bring an increasing number of law suits against manufacturers (in the USA). The courts are demanding that brochures, information sheets, labels, and technical manuals are written in comprehensible language, and that descriptions and instructions are legible and readable.

Comprehensible messages. A message is comprehensible if the receiver can grasp it without difficulty. It is difficult to create easily understood information. Esoteric and impenetrable jargon can be perceived as incomprehensible by the uninitiated. See *Providing simplicity, Providing structure*.

Comprehension. In one industry sample 56 percent of the documents that workers were required to understand were above their level of comprehension.

Computer images are digital. In some systems the square or rectangular pixel is either white (light) or black (dark). In other systems the pixels can be varied in a grey-scale and/or in a colour range. The number of colours that can be reproduced depends on the computer, operating system, program, and computer. Quite often eight bits of information is used for red,

green, and blue colours, respectively, and eight bits for text and graphical effects. Each colour can be stored in 256 levels. In total it is possible to create 16 millions of nuances in the image. Pixels are always small compared to the screen.

Computer literacy is the ability and knowledge to use computers and technology efficiently. A computer-literate person only needs to be a computer user, not a computer programmer. As personal computers have become commonplace and more powerful, the concept of computer literacy has moved beyond basic functionality to more powerful applications under the heading of *multimedia literacy*.

Computer literacy is the ability to use computers. Computer literacy relates both visual literacy and media literacy to the traditional concepts of literacy, reading and writing. Better user interfaces would probably fast increase the number of computer literate users.

Computer literate. A computer literate person only needs to be a computer user, not a computer programmer.

Computer media are fields such as artificial intelligence, expert systems, computer programs and computer games. A 'computer program' is a program in a form enabling it to be processed by a computer. Computer programs may require transformation, e.g. by compilation, assembly or interpretation of all available data, before being executed by the computer.

Computer science comprises research on the principles for construction, operation, programming and applications of computers. A special focus is on computer software, and analysis of

instructions and information needed to solve formalised problems.

Computer screens can be constructed and manufactured in many different ways and have very different characteristics. Examples are picture tubes, liquid crystals, plasma screens, magnetic field boards, light emitting diodes, and head up displays. Computers may also be connected to different kinds of projection systems.

Computer-aided design, CAD. See *Technical visualization*.

Computer-aided instruction, CAI, is a kind of E-learning. See *E-learning*.

Computer-assisted instruction is a kind of E-learning. See *E-learning*.

Computer-based instruction, CBI, is a kind of E-learning. See *E-learning*.

Computer-based training, CBT, is a kind of E-learning. User-friendly computer-based training environments help learners gain and maintain confidence in their ability to perform with minimal confusion. User-unfriendly training environments do the opposite, leaving learners confuse, lost, frustrated, and lacking confidence in their ability to perform satisfactorily. See *E-learning*.

Concentric circles around a centre is a schematic picture. See *Metaphorical pictures*.

Concept. A concept is an idea of something formed by mentally combining all its characteristics or particulars, a mental notion

of a group of referents. For the concepts to be represented verbally and in writing, they must be given linguistic expressions: denominative and descriptive. Man is the only terrestrial species to acquire a language in the true sense of the word. However, the ability to form concepts is not unique to the human brain. Primates and several lower animals are capable of entertaining general, picture-based concepts.

Concept systems. See *Conceptual model*.

Concepts and terms. The principles that guide the selection of terms and concepts within a project may be summarised as follows. 1) Define and describe concepts and terms that are specific to the project. 2) Concepts and terms must be relevant and suited to their purpose. 3) Create concepts and terms early in the development phase. Avoid terms with several different meanings. 4) Use words that convey a positive message and avoid ambiguous words. 5) Be careful with acronyms.

Conceptual hierarchies. See *Conceptual model*.

Conceptual model. A conceptual model is a systematic description of the relationships between concepts in a subject field, a particular area of thought. The definition of individual concept's super ordinate, subordinate, and collateral relationships is an important part of terminology work. An *associative concept system* shows relations, that is, functional relations, between different concepts. A *generic concept system* shows different types of hierarchical concepts. A *partitive concept system* shows the different parts that together form a super ordinate concept. The same concept can be included in the different types of conceptual systems.

Concrete image content may only be assessed and measured by subjective means. There are functional and suggestive properties.

Condensed are type designs that are horizontally narrow.

Conditioning. In accordance with the behaviourist theory, we learn to act in acceptable ways by being praised and rewarded when we do good things and by praise being withheld when we do not. To get attention, it is most effective to present material in a way that is both interesting and understandable to those who are to learn it. The behaviourist learning is a process of expanding the behavioural repertoire, not a matter of expanding the ideas in the learner's mind. Behaviourism grew in popularity throughout the 1920s, 1930s, and 1940s. There are two traditions within behaviourism: *Classical conditioning* and *Operant conditioning*.

Cone of experience. The basic assumption in the model "cone of experience" is that learning will be more complete as the number of cues in the learning situation increases.

Conjoint retention. See *Dual-coding memory model*.

Connectedness principle is also called *Element connectedness principle*. It states that elements that are connected by other elements tend to be grouped together. We have a tendency to see uniform, connected regions as single units. The region may be points, lines, or a more extended area. This is generally how we perceive diagrams.

Consistency. Inconsistencies will confuse the readers. Always use the same words for the same concepts. Do not mix the

tenses. Avoid formal language. Do not write contracted forms, for example, *it's*, *he's*, *wouldn't*. Instead, use the expanded forms, *it is*, *he is* or *he has*, *would not*.

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Consistent style. For centuries monks produced hand-drawn manuscripts in their monasteries. They paid careful attention to the selection and placement of each graphic element, and they tried to maintain a consistent style throughout every single work.

Constance is an example of the script type style. See *Script type style*.

Constancy is our tendency to judge colour, contrast, shape and size as the same despite changes in distance, illumination, and viewing angle. See *Perceptual constancy*.

Construction drawing is a schematic picture. See *Plans*.

Construction of knowledge. Within any discipline, the construction of knowledge and its subsequent cultural practice is always elusive. If carefully read, early texts can yield voluminous information about the formation of a specific field, such as which the founders were, which discourses influenced their communications, and to whom and with what authority they spoke at the time.

Constructivism is a philosophy of learning. We *construct* our own “rules” and “mental models,” and our own understanding of the world we live in based on our unique sets of experiences. Learning, therefore, is the process of adjusting our mental models to accommodate new experiences. Rather than mapping concepts on the mind of the learner (as with objectivism) constructivism attempts to help individual learners construct their own knowledge from their own experiences and their own understandings of reality. The learner is the central focus in the constructivism model, not the instructor or the teacher.

Consumer markets. Consumer and leisure markets are expanding. One of the key marketing concepts in new media is to create products that will stimulate consumers into buying or renting the necessary hardware.

Content, context, format, and structure influence the viewer’s ability to perceive a message. See *Image content*.

Context. A picture has both an internal and an external context. Factors inside the medium are “internal context.” In books the internal context is the interplay between texts, illustrations, and layout. Movies and TV programs have sound with speech, music, and sound effects plus visual and audio metaphors. The entire communications situation, i.e., senders and their intentions for the picture and receivers and their circumstances (e.g., time available), is “external context.” See *Image context*.

Context dimension. See *Pictorial dimensions*.

Context perspective. The context in which a message is presented has a major impact on the way that the message is per-

ceived. It will influence interpretation and can convey a “pre-understanding” of the content. In information design a context perspective includes 1) the internal context (inner context), 2) external context (with close context and social context), and 3) personal context. Each context will influence the interpretation of the message. See *Pre-understanding*.

Context principles. Each context will influence the interpretation of the message. The close context and the social context are both external contexts. The information designer will have to: 1) Define the internal context for the message. 2) Define the external contexts for the message. 3) Define how the context may influence the interpretation of the message. See *Context perspective*.

Continuation marks appear sometimes in texts in magazines and other periodical publications. These marks may be arrows or triangles and a reference to page number.

Continuity law. See *Continuity*.

Continuity principle is also known as the *law of continuity*, *law of good continuation*, *line of direction*, *principle of good continuation*, and the *theory of direction*. We perceive a slow and gradual change in an auditory or in a visual stimulus as one single stimulus. Elements that are aligned are grouped together, and integrated into perceptual wholes. It is easier for us to perceive a smooth continuation of a line than an abrupt shift of direction. We understand the gradual changes in diagrams, and the climbs and declines of the bars in a bar graph. When there is an intersection between two objects, we tend to perceive this as two uninterrupted entities. See *Perception “laws.”*

Continuous tone is a complete range of gray, from black to white.

Contradictory messages often create more confusion than they provide help.

Contradictory relationship exists when the information in various channels conflicts. This is disastrous for any informative programme and any learning material. See *Modality*.

Contrast constancy is our tendency to judge contrasts as the same despite changes in distance, viewing angle, and illumination. See *Perceptual constancy*.

Contrast in typography may be achieved by using different colours, fonts, sizes, and styles. We tend to order impressions that form natural opposites, thereby reinforcing one another, in groups.

Contrast law. See *Contrast principle*.

Contrast principle is also known as the *contrast law*. Contrast is the difference between the brightest and the dimmest parts of a picture, or of a text. We tend to array impressions that form natural opposites in groups. Thereby the impressions are reinforcing one another. In nature, as well as in art and design, contrast is of major importance for our perception of a message. A specific line seems to be long when it is compared with a shorter line, but it seems to be short when it is compared with a longer line. The size of an individual area is always relative. It depends on our knowledge of its surroundings. The size of a circle in a picture means little to us. A hand gives the circle the

size of a tennis ball. A number of wavy lines going out in all directions from the circle make it the size of the sun.

Convexity principle, or *law of convexity*, states that convex patterns will be perceived as figures.

Cooperative learning consists of instructional techniques that require positive interdependence between learners in order for learning to occur. In cooperative learning the dialogue is primarily between students, not with the teacher or with traditional teaching materials. However, a continuous dialogue with the teacher is desirable to secure understanding of the subject matter content. Cooperative learning is effective for developing problem solving skills in various content areas and grade levels. From a teaching philosophy perspective, cooperative learning is consistent with constructivism primarily due to the role of social interaction.

Coordinate grid is a kind of graph. See *Graphs*.

Copperplate engraving. In copperplate engraving the image is engraved in a plate of copper, which transfers the printing ink to the paper. The line is very distinct and ends in a fine point. The oldest copperplate engraving was printed 1446, but it is supposed that the technology existed already a hundred years earlier. Copperplate engravings were first used for book production in 1476. During the 17th century copperplate engraving became the most important method for production of pictures in books. Copperplate engraving has generally been replaced by photoengraving. Today graphic artists use this method as a fine arts technique. Steel-die engraving is still used extensively for printing money, stocks, postage stamp, and other high quality

prints. Copper plates and steel-dies are produced manually, mechanically, or photo-mechanically.

Copy usually means the text in a design, but also all the elements of a finished design.

Copying. Modern zoom optics in combination with microelectronics have given birth to small and handy copying machines that automatically reduce and enlarge, retaining good quality. Concurrent with simpler handling and better quality, the consumption of copies increases. See *Colour laser copier*, *Xerography*.

Copyright. The rights of copyright holders are protected according to international conventions, terms of delivery and agreed ethical rules. Full copyright protection for a “work” or a “production” requires originality, creativity, and fixation. This protection is international. The name of the copyright holder must be stated in each published document containing pictures and texts. For “picture theft” occurring intentionally or through gross negligence, the penalty is fines or imprisonment for up to two years.

Copyright Act. All artistic works are protected for the originator's entire life plus an additional 70 years. Thus, many works are protected for more than 120-130 years. This protection is international.

Copyright–archive photographs. Publishing rights to archive photographs are usually bought for each specific publishing occasion. The buyer may not then transfer the publishing rights to any third party without written permission from the

rightful copyright owner. In practice, also almost all photographs can be said to have some “artistic merit” and thus have protection for 70 years after the death of the copyright holder.

Copyright–commission. When photographs are produced on commission, the client usually pays for and enjoys all copyright rights, including rights to prints made from the originals. Usually the client can freely utilize the commissioned pictures in any way desired.

Copyright–economic right. The *economic right* implies the sole right of the originator to determine the making of copies and presentation of the work in public.

Copyright–holder. The individual or organisation who owns the copyright to protected artistic works. See *Copyright economic right*, *Copyright idealistic right*.

Copyright–idealistic right. The *idealistic right* implies the sole right of the originator to decide over the use of the work.

Copyright–illustrations. For drawn illustrations the client usually pays for 1) the actual sketching, 2) the drawing work, 3) the originals, and 4) the reproduction rights for a particular publication. After publication the physical drawings, the originals, usually remain the property of the artist. If an original should be damaged or lost the artist becomes entitled to financial compensation, equivalent to the “re-acquisition cost.” The name of the picture creator or copyright holder must be stated in each printed document containing the pictures, preferably, but not necessary, in direct conjunction with the pictures.

Core competencies. In 2005 the partners of a federal US-EU Fund for the Improvement of Post-Secondary Education (FIPSE) grant for the Development of Core Competencies and Faculty and Student Exchange in Information Design listed the following essential competencies for an information designer. An information designer should be:

- Able to identify the purpose and audience of a given project and explicitly design effective structures, information, and presentation appropriate to that project.
- Able to cooperate with specialists to understand knowledge structures and the data/information in terms of content, topic and cultural context.
- Able to organize content, including writing, editing, and schema technologies.
- Able to understand and use various communication models to form information in a manner appropriate and effective for the data and the user.
- Able to determine and coordinate the best delivery method/media requirements to make the information accessible and useable by the given audience, including visual, haptic, and auditory delivery methods, and computational schema.
- Able to use appropriate presentation systems and environments, including software, hardware, and digital presentation technologies.
- Able to assess the success of a prototype, using established usability and accessibility guidelines and testing methods.
- Understand local, regional, national and global realities in problem assessment.

- Understand and apply the business aspects of developing and delivering information.
- Understand the ethical challenges that arise in everyday work environments and the necessary commitment to professional and ethical behaviour.

Corona is a classical newspaper typeface.

Corporate identification focus on identity, but corporate literature will often inform, and corporate advertising may also have a persuasive purpose.

Cost effective typography may be developed according to the following criteria and requirements:

- The text must exhibit good legibility. Because the typography should provide ease of reading without being “visible” (that is, without arousing notice), we must avoid unusual typefaces.
- Our point of departure should primarily be the reader's psychological capacity for perception, and secondly the potential performance of the technical equipment at hand.
- It should be as easy as possible for technical writers and editors to handle templates for graphic forms. Thus, these people should be given the necessary training to handle computer programs and the like where these templates are available.
- Size ratios in typography and layout should be based on conventions of typography and on research findings in perception psychology.
- The typography and layout should be acceptable in many countries, even though national tastes may vary widely.

- The typography should be adapted to the technology, that is, it should look good when printed on a laser printer, and when copied on an ordinary office copying machine. Look for, and adapt to the weak part in the production chain.
- The typefaces should be available as standard selections in computers and laser printers all over the world. Even so, we have to accept the fact that printouts made by different printers will not be identical in appearance.
- The typography should usually be “economical.” It should be possible to accommodate a great deal of information in a limited space without a crowded appearance.
- We should choose typefaces with high x-height for good legibility, even when small type sizes are used.
- The typography and layout should produce good results on standard paper. See *Standard paper*.
- The dimensions of pages and length of lines are given in centimetre or millimetre. Type sizes are given in “points.” See *Size of type*.
- It should be possible to print a document and insert the pages directly into a loose-leaf binder. This means that right-hand and left-hand pages should have the same appearance, basically a right-hand page layout.
- If a document is to be reproduced using conventional technology, it should be possible to use printouts of it from a laser printer or from a phototypesetter as a basis for direct reproduction. When A4 is reduced to 80.4%, the result conforms to the conventional printing format, G5 (169 x 239 millimetre).
- Before conventional printing, the layout of right-hand and left-hand pages may easily be changed.

- All documents might be coded in accordance with the SGML standard, so that it is easy to use the information in different ways, and in different formats. Sometimes other standards may be used (like HTML, and XML).
- Reduction through successive refinement is the best way to reach clarity. To create an elegant solution, anything that is not essential to the communication task has to be removed.

Cost of reading and understanding text and pictures in a document is in most cases many times greater than the cost of producing the document. The greater the number of people who are meant to read a text, the greater the incentive is to expend extra effort on making it easy to read.

Costs. The information designer must have control over the costs for the design and production of the information material. It is, however, also important to consider and plan for future costs related to technical production, distribution and storage. This should be done early in the design process.

Course objectives. We need to define the purpose of a course. The objectives of a course may be: 1) to develop basic *theoretical knowledge* of *abcd*, (2) to develop an *active, analytical and critical attitude* with respect to *defg*, and 3) to *practice* some editing of *ghij*.

Creative processes. The sender's creative processes are influenced by message design principles, and are performed with message design tools suitable for the type of representation that has been selected. Message design principles can be seen as a set of guidelines for design and development of messages. Main creative processes for a verbal and visual message include an-

alysis and synopsis, production of draft, production of script, and production of original and master.

Credibility is the possibility to understand a message and to be able to believe that the information is honest and correct. A high credibility message has a good structure, convincing arguments, proper references, and relevant examples. See *Credibility–context*, *Credibility–medium*, *Credibility–message*, *Credibility–receiver*, *Credibility–sender and source*.

Credibility–context. All receiver processes are influenced by prior experience in relation to age and gender, as well as by cultural, economical, historical, political, religious, and social factors. Context have a major influence on how various receivers relate to verbal and visual messages of different kinds, and on how meaning is subsequently constructed. A combination of a drawing and a photo will aid credibility to the message.

Credibility–eyewitnesses. Eyewitness identification has been cited as the single most persuasive source of all kinds of evidence that can be used in a court of law, but also as the most frequent cause of wrongful convictions. The reliability of testimony depends on many factors, including circumstances at the time of an event, the witness’s emotional state and memory function, etc.

Credibility–medium. The credibility of a medium depends on a number of variables, including receiver characteristics such as age, gender and level of education.

Credibility–message. A high credibility message has a good structure, convincing arguments, proper references, and rel-

evant examples. It must be possible to understand the message and to be able to believe that the information is honest and correct. Photographs and bright, warm colours confer credibility to an organization. Frequent use of archive pictures may cause quality problems. In many situations it may be better not to have any pictures at all than employing pictures with poor quality.

Credibility–receiver. The receiver's evaluation of the message will affect her or his evaluation of the source.

Credibility–sender and source. High credibility sources exert a more persuasive influence on the receivers than low credibility sources. Receivers believe in a message with high credibility.

Credits. In books it is quite common to give credits to artists and photographers in a special “List of illustrations.” In magazines and in newspapers credits are usually put next to the actual illustration, often in a vertical position. Credits to the author are usually in the form of a by-line.

Critical literacy is an instructional approach to literacy that advocates the adoption of critical perspectives toward text. It encourages readers to actively analyze texts and it offers strategies for uncovering underlying messages.

Critical television viewing skills include the ability to distinguish fact from fiction, to recognize and appreciate differing or opposing points of view, or both, and to understand the relationship between television programming and the printed word. Programmes for critical television viewing skills can success-

fully be integrated into the elementary and secondary school curricula. Critical television viewing skills could also be called “television literacy.”

Cropping. An original picture can often be improved by removal of irrelevant or distracting elements. Usually pictures can be cropped a little bit from all sides. In practice the photographer always performs some “initial cropping” while taking the actual photograph. When composing or taking a photograph, the photographer sets the boundaries or “frame” of the picture.

Cropping perspective. See *Overlapping perspective*.

Cross section is a schematic picture. See *Drawings*.

CRT, *Cathode ray tube*. See *Picture tube*.

Cue information theory claims that information that is shared between channels facilitates learning. Cues that occur simultaneously in auditory and visual channels are likely to be better recalled than those presented in one channel only. Close coordination between audio and video improved audio recall of television news and redundancy improved story understanding.

Cultural differences. Language and cultural differences impact the effectiveness of visuals.

Cultural literacy is the ability to converse fluently in the allusions, idioms and informal content that creates and constitutes a dominant culture. It demands interaction with the culture and reflection of it.

Cultural products. Pictures are cultural products shared by many individuals. Generally speaking people like pictures showing people.

Cultural skills. Professional communicators recognize that communication artefacts are often re-contextualized in unpredictable ways. Each time a text is reused, it becomes divorced from the social context that produced it. They are not invested in single meaning with a singular purpose. They recognize that the texts and artefacts they create can influence how others perceive their abilities, positioning them positively or negatively for future work. Professional communicators are perceptive of opportunities to build knowledge and to advance personal innovation and organizational agendas through formal and informal social networks within organizations. They can juggle multiple organizational constraints (such as deadlines or lack of funding) and multiple representations of the content (what the boss wants, what the client needs, and what the author thinks is best) and still maintain a focus on the stakeholders' needs. See *Professional communicators*.

Cumulative curve is a schematic picture. See *Graphs*.

Cuneiform script. The cuneiform script is distinguished by “wedge-shaped” marks in vertical columns on clay tablets. Scribes used a pen made from a sharpened reed stylus. The cuneiform script emerged in Sumer, an ancient civilization of southern Mesopotamia. It was used for more than 2,200 years. This writing began as a system of pictographs, and developed through several stages. The sign inventory was reduced from some 1,500 signs to some 600 signs. Writing became increas-

ingly phonological. The cuneiform script was eventually replaced by alphabetic writing. Writing numbers for record keeping began long before the writing of language.

Cursive type fonts has been seen as elegant, formal, organic, and personal.

Curvature in type is perceived as fluid, gradual, maternal, natural, organic, smooth, and soft.

Curved lines. There is a tendency for curved lines and smooth shapes to stand out more than straight lines and shapes made out of straight lines. See *Lines in visual language*.

Curvilinear decorations of Neolithic rock carvings are curved in various ways: 1) arcs, 2) circles, 3) “dot-in-circles,” circles with a dot inside, 4) serpentiforms (lines having the form of serpents), and 5) spirals.

Curvilinear perspective is a *Line perspective* and includes *Four-point perspective* and *Five-point perspective*.

Cutaway drawing, *cutaway diagram*, is a 3D graphics, diagram, or drawing. Some surface elements are removed, in order to show internal features. See *Drawings*.

Cutoff rules are horizontal lines that separate unrelated items above and below the line.

CXO. See *Chief Experience Officer*.

Cyan, the particular blue-green colour used in four colour process printing.

D

D series paper. In Sweden the ISO system of A, B, and C formats is supplemented by adding D, E, F, and G formats.

Dash. With the typewriters we had to create a dash (—) with two hyphens (--). With desktop publishing and typography this is not necessary. In 12 point type the em dash is 12 points wide. In desktop publishing we can create the em dash or em rule (—), the en dash or en rule (–), as well as the hyphen (-). The em dash is used to indicate a break in thought. There should be no space before or after the em dash. The en dash is used between numerals (e.g., pp. 33–45, and as a minus sign (e.g., –12).

Data refers to a collection of facts, specific details that are known. It may be results from experiments, measurements and observations of a set of variables. Data may consist of numbers, words, or visuals, often stored in lists and tables, in computer systems or on paper. Data are often complex, unorganised and unstructured. The information designer has the ability to organise, structure and present data as *meaningful information* in a chart, in a table, in a text or on a map et cetera.

Data visualization is the creation of visual representations of data. See *Information visualization*.

Decisions. Since the introduction of the personal computer there has been a rapid development in the production of information materials. Now an increasing number of decisions are being made on the basis of pictorial representations. Visual messages are a powerful form of communication. Because visual messages stimulate both emotional and intellectual responses

they make us think as well as feel. The ability for visual communication is becoming more and more important.

Declarative memory, or *explicit memory*, is the memory for facts, the memory of which we are aware. We know that we have learned something, and we can discuss this with others. See *Memory*.

Decoration. There are many situations where colour and typographic elements can be used for decoration. However, a decorative use of colour or typography should never be mixed with an intended use to provide a clear structure, simplicity and hierarchy. It must always be clear, and easy to understand for the receiver when colour and typography is used for decoration and when the use is meant to have some cognitive importance.

Decoration layout. See *Information layout*.

Defining the problem. During an introductory analysis and planning phase it is possible to organize the work, analyse the sender, analyse the intended receiver, analyse the intended message, and select a suitable medium. The message and the medium form the representation. The main goal in information design is *clarity of communication*, even if we also expect presentations to be aesthetically pleasing, and in some cases also intellectually rewarding. To fulfil this main goal all messages must be accurately designed, produced and distributed, and later correctly interpreted and understood by most of the members of the intended audience.

Definition. A definition is a linguistic description of a concept. The definition may normally replace the term in a text. A defini-

tion must not contain words like “often” and “sometimes”. A referent is an object, abstract or concrete, for which a name or designation stands and to which a specific concept refers.

Degree of detail. It is important to keep pictures as simple as possible. A visual should contain the details that are essential in communicating the intended message.

Degree of realism. A visual should usually possess a selected degree of realism and be true-to-life. Rather often this means culturally accurate detailed drawings in natural colour. However, to a large extent realism is determined by conventions. Realism is determined by the extent in which people consider something abstract or concrete. Cartoons, line drawings, and photographs represent a continuum of realism.

Demographic groups. See *Receiver groups*.

Density. According to the spatial concentration principle we perceptually group regions of similar element density. Thus a visual element may belong to one group even if it is as close to another group. See *Perception “laws.”*

Depiction of contents. An analysis of a photographic portrayal can examine positive versus negative depictions of individuals seen in photographs. Individuals are viewed more positively when they are shown walking, running or moving.

Depictive representations include physical models, pictures, and sculptures. See *External representations*.

Depth-enhancement dimension. See *Pictorial dimensions*.

Descender. The part of some lower case letters (g, j, p, q, y) that descend below the baseline.

Descriptions is a term for a group of information materials in the category *Factual information*. The purpose of descriptions is to enable the user to understand certain content with respect to its immediate or basic meaning. Descriptions depict what something looks like or how it works. Examples of fields for descriptions are: anatomical descriptions, biological descriptions, company descriptions, consequence descriptions, construction descriptions, ecological descriptions, economic descriptions, event descriptions, historical descriptions, job descriptions, medical descriptions, physiological descriptions, process descriptions: courses of events and processes, product descriptions: goods and services, system descriptions, technical descriptions. Descriptions can sometimes be related to facts, reports and instructions.

Descriptive representations include mathematical equations, spoken and written texts. See *External representations*.

Descriptive visualization of objects and systems has been an important aspect of technological development since the beginning of the industrial revolution. A technical illustration can always supplement a verbal explanation, and may sometimes replace the words. Descriptive visualization of objects and systems are also used in medicine and natural history, or scientific illustration. Another specialized subject area is architectural illustration. See *Technical illustration*.

Design is the identifying of a problem and the intellectual creative effort of an originator, manifesting itself in drawings or

plans that include schemes and specifications to solve the problem. The term *design*, or *final design*, also represents the outcomes of each specific design process, such as products, services, processes, and systems. See *Design aesthetics*, *Design areas*, *Design concepts*, *Design disciplines*, *Design discourses*, *Design language*, *Design levels*, *Design motto*, *Design perspective*, *Design principles*, *Design processes*, *Design rules*, *Design science*, *Design studies*, *Design team*, and *Design theory*.

Design activities. See *Design process*.

Design aesthetics is always related to the intended function of the information products intended for widespread distribution and use.

Design approach. See *Approaches*.

Design areas represent many parts of human activities. Examples are apparel design, architectural design, ceramics design, communication design, costume design, craft design, document design, editorial design, engineering design, environmental design, exhibition design, fashion design, fine arts design, furniture design, glass design, graphic design, image design, industrial design, information design, instruction design, instructional message design, interaction design, interface design, interior design, IT design, landscape design, light design, manufacturing design, mechanical design, message design, molecular design, ornamental design, package design, pattern design, persuasion design, poster design, product design, service design, text design, textile design, type design and urban design.

Design concepts include design processes, design activities, design areas, design levels, design perspectives, design discourse, and final designs. In information design the final designs may be called information materials or information sets.

Design disciplines. Many design areas are seen as academic design disciplines. See *Design areas*, *Design science*.

Design discourses, a concept that includes all the design literature and research reports dealing with design matters.

Design family. See *Design science*.

Design genus. See *Design science*.

Design language, a concept that describes how interfaces communicate what objects are to users, what they might do, and how they should be used.

Design levels, a concept that includes areas such as design of projects, design of processes, design of tools, design of products, and design of systems.

Design motto. Today's design motto is very much: "function can take any form." This phrase is an adaptation of the famous rule: "form follows function," which can be traced back to the American sculptor Horatio Greenough. He had used it in *Form and Function*, written in 1851. However architects, engineers and designers rarely follow this rule. Several authors have tried to develop firm rules, or regulations, on how to design information materials. It is, however, not possible to develop any firm design rules telling the information designer how to best design

a specific message and how to best develop specific information materials.

Design perspective, or *execution perspective*, of message design and information design includes 1) text design, 2) image design, 3) shape design, 4) sound design, 5) light design, 6) spatial design (expo and event), and 6) time design (the ability to deliver information when the user needs it). This concept has also been said to include views such as craft, manufacturing, technology, theory, and users. See *Context perspective*.

Design philosophy. See *Design science*.

Design principles. See *Message design principles*.

Design processes include cognitive as well as practical activities and aspects. The (final) design represents the outcomes of each specific design process, such as processes, products, services, and systems. On a theoretical level the intention of an overall design process, including process activities, might be the same regardless of the specific design area. Any design process includes the development from a concept or an idea to a final product. Steps in a design process may be called *design activities*, such as conceptual design, embodiment design, detail design, and design reviews. See *Message design processes*.

Design rules. It is not possible to provide any firm design rules. Several authors say: “It Depends.” In each specific case the information designer must be able to analyse and understand the problem, and find one—or more—practical design solutions. The *only* information design rule is: “Respect copyright, and other laws and regulations related to information.”

Design science is a large field of academic research, education and training. There are common problem areas regardless of what we design. In a common terminology the top level may be named “Families.” Next level may be called ”Genera.” The third level is “Species” (or disciplines). Each subject matter consists of a number of courses. In five design families the classification depend on the purpose with the design. We can design artefacts, different messages, performances, systems and processes, and our own environments. These design families are called 1) artefact design, 2) message design, 3) performance design, 4) systems design or systems development, 5) environment design, and 6) design philosophy.

Design species, or *design disciplines*. See *Design science*.

Design studies are a broad area of knowledge with connections to several other areas. Many studies have mainly dealt with various aspects of verbal information in different media. Quite often the pictures and images in the messages have been overlooked and forgotten.

Design team. The legibility of a graphic message is determined by the design of its text and pictures, as well as by their clarity. Usually a team of people with skills in different areas are working together. The task is usually too overwhelming for a single person. See *Instructional team*.

Design theory. The term *design theory* has several meanings, related to context, perception, practise, and supporting sciences. Design theory deals with:

- *Context*: the interpretations of design within the context. It may be a political and cultural context, which influence how humans understand and create meaning.
- *Perception*: socio-psychological phenomena when we focus on how design can be perceived and visualised.
- *Practise*: how to organise the knowledge of design as a practise when design is seen as craftwork.
- *Supporting sciences*: how design is a part of different supporting sciences and therefore is explained by several theories.

Design tools. The design process and sub-processes are influenced by message design principles, and are performed with message design tools suitable for the type of representation that is selected during an early phase of the work. Main *message design tools* include words and text (printed and spoken), symbols, pictures (drawings and photographs), graphical form (typography and layout), sound and sound effects. These tools have different properties that offer and restrict the foundations for communication.

Designed messages are the finished originals that are ready for production.

Desktop digitizer. Since photography includes a full spectrum of greys it is not possible for a computer, working in a bit-mapped mode, to represent the shades of grey. Computers can only show black and white. There are different kinds of digitizers. A scanner allows the user to digitize all kinds of illustrations on a paper. See *Desktop scanner*.

Desktop publishing systems use a version of the Pica system for measuring size in typography. Here 1 pica = 12 points = 12 pts = 1/6 inch = .1667 inch = 4.23 mm. 1 pt = .3528 mm (72 pts/inch). See *Pica system*.

Desktop scanner. A desktop scanner works with CCD-technology. Most desktop scanners work with 300 or 400 dots per inch. The scanner can digitize an image either as a full-tone picture or as a half-tone picture. The low resolution of computer screens, scanners, and laser printers, and the vast amount of storage that it takes to store a high-resolution image electronically make digitized images possible only as low-quality simulations of photographs. See *Desktop digitizer*, *Full-tone picture*, *Half-tone picture*.

Detail map is a schematic picture. See *Maps*.

Diagonal lines are unstable and attract the eye. They give the impression of movement, creating visual stress. Artists may use this implied motion when they wish to convey energy or action in their works. Lines that reach out from one point in different directions may be perceived as aggressive or violent. See *Lines in visual language*.

Diagrammatic literacy is a matter of getting people to make better decisions based on graphical information. Reading diagrams involves perception, domain knowledge, narrative, motivation and bias, as well as social consensus. Experts and novices apply different mental strategies when they read diagrams. The experts base their interpretations on underlying principles and domain based categories. Beginners, however, rely more on

visual patterns in the diagrams. So far there are no universal conventions for diagrams. See *Diagrams*.

Diagrammatic rendering is a schematic picture. See *Drawings*.

Diagrams is a group of schematic pictures that systematically show the relationship between various factors. Relationships between visual elements in a diagram mirror relationships between objects in the world. Diagrams depend on colour, line, plane, point, texture, value, and volume as well as text. It is far too easy to make diagrams confusing, difficult to understand, and misleading. Diagrams need to be correct and simple. There are many kinds of diagrams: 1) Pictograph, or isotype system chart. 2) Line diagram. 3) Bar charts. 4) Pictorial length chart. 5) Tri-linear chart. 6) Pictorial area chart with comparison of areas. 7) Polygon chart. 8) Circle chart with comparison of areas. 9) Pie charts, or circle graphs. 10) Parallelepipeds. 11) Spheres, comparison of volumes. 12) Surface chart. 13) Segmented volumes. 14) Pictorial characters in space. 15) Metroglyph chart. 16) Bubble chart. 17) Kite chart. 18) Block diagram. 19) Four-field diagram. 20) Quantity diagrams, totality and subsets. 21) Tree diagram, organizational and hierarchical structures. 22) Flow diagram, or flow chart. 23) Web diagram, planning and production. 24) Circulation diagram. 25) Circuit diagram. 26) Pictodiagram. 27) Transportation diagram. See *Diagrammatic literacy*.

Diaspora literacy is the ability to understand and/or interpret the multi-layered meanings of stories, words, and other folk sayings within any given community of the African dias-

pora. These meanings go beyond literal or typical literary interpretation into an area of folk understanding.

Diderot. Denis Diderot (1713–1784) was a French art critic, philosopher, and writer. He was a prominent person during the Enlightenment. In 1748 Diderot and the mathematician Jean le Rond d'Alembert (1717–1783) started the work with the general, great, innovative and epoch-making new French encyclopaedia. Both of them were important contributors to the *La Grande Encyclopédie*. Diderot assumed the editorial responsibility after ten years. Diderot was a scholar with crucial importance for the development of combined verbal and visual messages. See *La Grande Encyclopédie*.

Didot. The French engraver, printer, and type founder *Firmin Didot* (c 1764–1836) designed the *Didot typeface* about 1800 and revolutionized the book trade by cheap editions.

Didot system is a system for measuring size in typography. It is used in most parts of Europe (except Great Britain and France). Here 1 Cicero = 12 points = 12 p = .1780 inch = 4.511 mm. 1 p = .3759 mm (67.6 pts/inch). See *Size of type*.

Differential threshold, or *just noticeable difference*, is the least possible difference that can be detected between two similar stimuli.

Differentiation. It is essential to be able to differentiate elements from one another.

Digital coding. Data are stored in digital form as sequences of discrete values (based on 0 and 1). Most digital media are based on translating analogue data into digital data and vice-versa.

The following example illustrates the difference between analogue and digital storage of data. A single page of a book can hold about 2,500 characters (i.e., 50 lines containing 50 characters, including spaces between words). Storing the same book page in digital form would require 20,000 bits of information. This may seem like a great deal but it is still almost negligible compared to the storage and transmission of data in other media. One second of television is equivalent to 250 pages with text. See *Analogue coding*.

Digital deception. Sometimes digital deception, or *digital photo manipulation*, may enhance a message. Sometimes a photographer may use image manipulation methods in order to edit her or his own pictures.

Digital documents may be coded in accordance with the SGML standard, so that it is easy to use the information in different ways and in different formats. Sometimes other standards may be used (like HTML and XML). See *External access*.

Digital educational collaboration is a kind of E-learning. See *E-learning*.

Digital image manipulation. See *Image manipulation*.

Digital literacy is the ability to locate, organize, read, interpret, understand and use images, sound and text in digital environments. A digitally literate person can evaluate and apply new knowledge gained from a wide range of digital sources in order to create and reproduce data and images in multiple formats through digital manipulation.

Digital maps. Missiles, like cruising missiles, navigate by comparing radar-images, TV-images, and satellite data with stored, digital maps. Thus, the computer system of a missile works with information representing images and iconic signs. Search is likely to be relatively unregulated, and the structure is probably non-linear rather than linear. The computer systems are advanced and have to work very fast.

Digital photo manipulation. Sometimes digital photo manipulation, or *digital deception*, may enhance a message. Sometimes a photographer may use image manipulation methods in order to edit her or his own pictures.

Digital techniques are employed in the recording as well as the editing and distribution of TV-programs. When digital techniques are introduced, a common world standard will be possible. Then the problems caused by the different TV-systems in use today, NTSC, PAL, and SECAM, can disappear. This will facilitate international distribution of programs. However, there are several hundred million TV-receivers in use in the world and the electronics industry was set up to manufacture conventional TV-sets. That means that it will take some time before the new technique will be in common use.

Digital Video Interactive, DVI, is similar to CD-I and developed originally by the American company RCA and available from Intel. Since one hour of digital storage of video information occupies 65,000 megabytes, DVI operates with advanced computerized image compression.

Digital visual literacy, DVL, is the ability to create and understand visual information created with a computer.

Dimensions. Having a “one-dimensional” and a “two-dimensional” representation at the same time, or even one or more “one-dimensional,” “two-dimensional,” and “three-dimensional” representations, at the same time, is possible, even commonplace. We may also add “access time” as another dimension. In the future, media might also be able to represent smell and taste, which would add still other dimensions.

Diminishing perspective. See *Line-based positional perspectives*.

Dingbats. See *Ornaments*

Directed experience. Movies as well as TV- and radio-programs are presented from the beginning all the way to the end. In fact movies used to conclude with the text “THE END.” The directors and the producers are in complete control of the order and of the way the information is presented to us. As viewers we are restricted to choose between watching and not watching the program. We can associate freely, and different people often make different interpretations of the same program.

Direction. Studies of eye movements and fixations have shown that various people look at the same picture in different ways. By organizing the graphic elements it is possible to direct the eye movements within the picture. Lines, shape, scale, perspective, position and orientation of objects are all essential parts in providing direction in a picture. Using lines with arrowheads is probably the easiest and most powerful way to show direction.

Directions for use are written instructions explaining what someone has to do in order to use some device etc. This especially applies to instruments, machinery and tools. The people who will be using the product in question are the target group for directions for use. Directions for use are often in the form of printed sheets or booklets as well as in digital media. Users often need the instructions in directions for use just to 'get started'. Once a TV set and a VCR have been installed, using these products seldom presents any problem. Incorporating directions for use into technical systems is becoming increasingly common. Necessary information can then be viewed on a monitor. Since information cannot be accessed in the event of a power failure, we will still need to have some information in graphic media in the future.

Discipline. See *Design science*.

Discontinuity. See *Emphasis in layout*.

Discovery theory. See *Perceptual learning*.

Discrepancy. There is often a considerable discrepancy between the sender's intended message and the message perceived by the receiver, both as regards words and images. It is sometimes doubtful whether receivers perceive anything. Everything usually works better when words, pictures and graphic design are allowed to interact.

Disinformation is the opposite of information design.

Dissatisfaction with the execution of a message may cause dissatisfaction with the content of the message. Therefore the information designer has to consider the legibility of text

printed on paper, displayed and projected on screens, as well as legibility of pictures and legibility of layout. See *Legibility*.

Distance education. In traditional distance education much work was put into developing teaching materials. This required heavy investment and was based on the assumption that a large number of people should learn the same subject matter at the same time under the control of a teacher. Large companies with employees at multiple geographic locations have developed their own internal webs, Intranets. They use their webs as information and learning tools, and are moving from instructor-based learning to multiple learning formats. An ever-increasing number of schools and universities offer an ever-increasing number of courses over the Internet.

Distinctness. It is important that the listeners clearly understand the words in oral presentations. Readability in the written message is comparable to distinctness in the spoken message.

Distribution processes. The sender's distribution processes are influenced by distribution principles, and are performed with distribution tools. Distribution principles include economy, efficiency, and timing. The processes include advertising, billing, bookkeeping, distribution, marketing, selling, and stock keeping. The tools include databases, stores, warehouses, etc.

Divine proportion. See *Golden mean*.

Documentalist, or *informatic*, is a person who collects and tabulates scientific information. This information is often sought in national as well as international databases.

Dogmatic design theory deals with how a model is transferred to a concrete object.

Doing the touching-up is the fourth sub-process in the actual writing of a text. Check that the finished text corresponds to the planned text in accordance with the requirements. Edit the text. Check the style and grammar. See *Message design processes, Writing and drawing processes*.

Donatello (c 1386–1466) was the most significant sculptor in the Italian Renaissance. He applied the principles of central perspective in his shallow relief sculptures. Donatello worked in bronze, clay, marble, and wood. His most famous work is the bronze *David*, about 1440s. This sculpture is independent of any architectural surroundings, and the first known freestanding nude statue since ancient times. Donatello had many followers within the European art. See *Renaissance*.

Dot. A dot is a full stop (.) to mark the end of a complete sentence.

Dot map is a schematic picture. See *Maps, Snow*.

Dot matrix printers are impact printers. They produce dot matrix characters by pressing thin needle points, “needles,” arranged in a matrix pattern, 5 x 7, 7 x 7, or 7 x 9, to a carbon paper or a ribbon lying close to a paper. The needles form different characters, letters, digits, or parts of a picture. Dot matrix printers work with a resolution of 50-100 dots per inch. This is the same resolution as that of many computer screens but considerably inferior to the printout quality of laser printers.

Dots. See *Dots in mathematics*, *Dots in typography*, *Dots in visual language*.

Dots in mathematics. A *point* is a *location*, defined by the crossing of two very thin lines. Any point has an exact position in a specified context, an exact coordinate on a plane. However, the point has no size, no shape, no colour, no value, and no grain. A point is often represented by a *dot*, which is the smallest graphic element in visual language.

Dots in typography. A dot is a full stop (.) to mark the end of a complete sentence.

Dots in visual language. A dot is the smallest graphic element in visual language. The dot is usually a meaningless or non-significant image element, such as one of many halftone dots, but it could also be a syntagm, such as an eye in a cartoon-face. Or it may even have a complete meaning, such as a ball in midair. It all depends on the situation depicted. With respect to the technique and the different types of visuals, dots can vary in size, shape, colour, value, grain, context, as well as position. Usually single dots do not carry any meaning. It can also provide harmony or stress to a given composition. See *Basic elements*.

Double-loop learning has been called “higher level learning,” and “strategic learning.” It is a change process influenced by surrounding environments. Results are created by new procedures. Double-loop-learning concentrates on why and how processes change, as generative learning, or learning to expand possibilities. It requests for a change of knowledge base or specific competencies or routines.

Draft. See *Production of draft*.

Drawing process. See *Writing process*.

Drawing style. A drawing style that includes many different kinds of patterns, shadings, and lines, and inconsistent use of symbols may obstruct the reading of the pictures.

Drawings. Subjects express opinions about circumfluous events on their drawings. They also tend to feel that their particular interpretations are the correct ones. Drawings may be created in many artistic styles. The purpose of schematic drawings is basically to inform, not to decorate. Schematic drawings must not be excessively imaginative or unnecessarily abstract. Clarity is the most important factor. Important types of drawings are: 1) Stylized drawings. 2) Sketches. 3) Diagrammatic renderings. 4) Informative drawings. 5) Analytical drawings. 6) Cross sections. 7) Exploded drawings. 8) Cutaway drawings. 9) Panoramas. 10) Silhouettes. 11) Cartoons. 12) Comic strip sequences.

Drop caps are lowered initial letters. See *Initial letters*.

Dropout is a halftone in which no dots fall on white areas.

Drum-scanner. Large professional systems for integrated image and text processing often contain a drum-scanner. The original, a slide, or a print, is fixed on a rotating drum. A laser beam reads the picture with a resolution of up to 300 lines per inch creating up to 75 dots per inch for yellow, cyan, magenta, and black, respectively. The digital image information can then be processed in different ways. It is possible to change the scale, crop the picture, and manipulate the contents. It is, for exam-

ple, possible to move picture elements, make copies, put in text or symbols, etc.

Dry point etching. In dry point etching the artist works the copper plate with a fine point tool. The line in dry point engraving is soft and fluffy. Graphic artists mainly use dry point etching as a fine arts technique.

Dual-coding. See *Dual-coding memory model*.

Dual-coding memory model, or *dual-coding theory* (or just *dual-coding*), proposes a verbal system for processing and storing linguistic information and a separate non-verbal system for processing and storing spatial information and mental imagery. These systems can function independently, but are also interconnected. The image is centrally important in facilitating long-term retention, at least for adults.

Our memory for pictures is superior to our memory for words. Information presented in pictures is encoded twice, once as a picture and once as a verbal label that names the picture. The redundancy in memory that results from this “dual coding” or “conjoint retention” means that information can be retrieved either from the pictorial or from the verbal memory. It is also known that our memory for a picture-word combination is superior to our memory for words alone, or our memory for pictures alone. This is called the pictorial superiority effect.

Dual-coding theorists accept that mental images are not exact copies of external pictures. Instead mental images contain information that was encoded after perceptual analysis and pattern recognition. Images are organized into sub-pictures at the time of perception. Mental representations have their develop-

mental beginnings in perceptual, motor, and affective experience and are able to retain these characteristics when being encoded so that the structures and the processes are modality specific. Memory is better when a verbal and a visual code are activated at the same time, rather than only one of them.

In conclusion, results from several experiments show that when the contents are the same in visual, audio, and print channels, learning is maximized. The content, the structure, the context, and the format of a visual influence the viewer's ability to perceive its message.

Dual-coding theory. See *Dual-coding memory model*.

Dust cover, or *jacket*, is the paper wrapper of a hardbound book.

DVI, *Digital Video Interactive*, is similar to CD-I and developed originally by the American company RCA and available from Intel. Since one hour of digital storage of video information occupies 65,000 megabytes, DVI operates with advanced computerized image compression.

DVL, *Digital Visual Literacy*, is the ability to create and understand visual information created with a computer.

E

E series paper. In Sweden the ISO system of A, B, and C formats is supplemented by adding D, E, F, and G formats. E5 (155 × 220 mm) and G5 (169 × 239 mm) are popular for printing dissertations.

E-learning is the use of communication technologies and electronic media in education, learning and teaching. The concept E-learning includes the use of all kinds of communication technologies and electronic media that can deliver animation, audio, images, text, and video. E-learning can be instructor-led and also self-paced. A physical or a virtual classroom may be used. In distance learning instructors and students may live in many parts of the world. The term E-learning is more or less synonymous with computer-aided instruction, computer-assisted instruction, computer-based instruction, computer-based training, digital educational collaboration, internet-based training, multimedia learning, online education, technology-enhanced learning, virtual education, virtual learning environments, and web-based training.

Early books. Before the invention of the printing press, almost all books were copied by hand. The bookmaking process was long and laborious. The first books used parchment (sheepskin) or vellum (calfskin) rather than paper. The book covers were made of wood and covered with leather. This made books expensive and rare. During the later Middle Ages books were often chained to a bookshelf or a desk to prevent theft from the libraries. When the moveable type was introduced during the 15th century, it became possible to produce books in larger quanti-

ties. This was the beginning of a cultural revolution. A dramatic growth in the quantity and quality of books and other printed learning materials like maps followed. Informative drawings developed. See *Reuse*.

Early graphic design. Already 5,000 years ago the Egyptians combined their writing system with illustrations in illustrated manuscripts and wall decorations. In the fifth century, the Greeks introduced the concept of symmetry. This was based on their observations about the natural world. Later, Roman artists developed symmetric arrangements of letters and graphic elements. For centuries monks produced hand-drawn manuscripts in their monasteries. They paid careful attention to the selection and placement of each graphic element, and they tried to maintain a consistent style throughout every single work.

Early information design. See *Albertus Pictor*, *Amenhotep II*, *Basilica of San Francesco d'Assisi*, *Bayeux Tapestry*, *Books of the dead*, *Gianlorenzo Bernini*, *Jelling*, *Rock art*, *Sennefer*.

Early pictures. “What writing is to the reader, pictures are to those who cannot read,” stated Pope Gregory the Great (about 540–604). Already by the Middle Ages, a wide spectrum of image types was used for teaching and training purposes. The pictures ranged from realistic drawings to abstract diagrams. Pictures were used for the identification of important medical herbs, for instruction on how to load and use a cannon, how to swim, how to fight with a sword, how to construct a building, and for training the art of angling. Some manuals and instructions from the 15th century and onwards are preserved. A fen-

cing manual by Hans Thalhoffer (1443) includes visual instructions in wrestling and unarmed combat.

Early writing systems. Early writing systems were developed in Sumer about 5,200 years ago, in Egypt about 5,200 years ago, in China about 3,200 years ago, and in Mesoamerica about 2,600 years ago. Early Egyptian hieroglyphics used pictorial elements to convey messages. Simple images could stand for letters or words in a written language. This was one of the earliest examples of being able to “read” and to “compose.”

Echoic memory (hearing) is closely related to the sensory memory. This memory precedes the integration of signals from various sensory systems. See *Sensory memory*.

Ecoliteracy, *ecological literacy*, is the ability to understand the natural systems that make life on earth possible.

Ecological literacy, *ecoliteracy*, is the ability to understand the natural systems that make life on earth possible.

Economic literacy is knowledge and understanding of basic economics. Economic literacy is a vital skill in the modern society, just as vital as reading literacy. See *Numeracy*.

Economic right. See *Copyright*.

Economical typography. See *Cost effective typography*.

Editing of visuals. We may crop or expand the original picture. Parts of the picture can be deleted, added, altered, moved, or changed in shape or position. The picture can be enlarged or reduced. A colour can be changed, removed, or added. The pic-

ture's expressiveness can be altered by the choice of reproduction method.

Educational objectives. An information designer needs to develop skills in writing comprehensible, clear and consistent texts, in creating clear illustrations, and in creating a clear, transparent typography and layout that aids understanding and learning. The main goal in information design should always be clarity of communication.

Educational posters are used in schools and other educational settings. In Sweden the Golden Age for educational posters lasted from 1920 to 1950. An individual school could have a collection of several hundred posters. These posters illustrated animals, history, landscapes, plants, religion etc. There can be no doubt that the educational posters had great significance for both teachers and students. In many countries filmstrips, slides, and overhead transparencies replaced educational posters. Now these media have been replaced by image databases on the Internet. See *Poster*.

Educational psychology. While the content of a visual image is “pictured” to oneself, the content of a verbal image is “spoken” to oneself. In “educational psychology” modality refer to inner, mental activities and experiences. People may have auditory modality, kinaesthetic or tactile modality, visual modality, or a combination of these modalities. See *Auditory modality*, *Kinaesthetic modality*, *Mixed modality*, *Modality*, *Visual modality*.

Educational technology is the application of research in human learning and communication to the problems of teach-

ing and learning. This includes a systematic way of designing, carrying out and evaluating learning and teaching in terms of specific objectives. Major contributing fields are cognitive psychology, social psychology, psychometrics, perception psychology, and management.

Educational theory. The term “learning style” is used in approximately the same way as the term “modality” is used in “educational psychology.” Auditory, kinaesthetic, and visual learning styles are said to comprise different systems, through which we interpret our day-to-day experiences. *Auditory learners* learn by hearing. *Kinaesthetic learners* learn by doing. *Visual learners* learn by seeing.

Educational visualization is using images to explain topics that are difficult, or impossible, to see. Atoms are far too small, and planets are too far away. See *Visualization*.

Effect on learning. Pictures can have a positive, a neutral, and also a negative effect on learning.

Effective headings. Well-written headings help the readers to quickly find the information they want in a document. Headings show the readers how the text is structured. Never end a heading with a full stop. However, a question is followed by a question mark (?), and an exclamation is followed by an exclamation mark (!).

Effective typography. See *Typography*.

Effective visuals. Visuals for information should be attractive but “unambiguous,” not too “artistic” and therefore ambiguous. To increase interest in a material it might be a good idea to use

a blend of visuals. The type of visual that should be used must be determined in each case. It is often easier to control the production of a drawing than the production of a photograph. So a drawing may be the only realistic alternative in many instances. Effective visuals for information should create an experience for the reader. The reader must: 1) See, or rather “discover” the picture. 2) Pay attention to the picture. 3) Actually read the picture in an active and selective way.

Effectiveness. The effectiveness of a visual depends on the medium, on the type of information, and also on the amount of time learners are permitted to interact with the material. Also language and cultural differences may impact the effectiveness of visuals. Furthermore it is also known that stylized and “simple” pictures are more effective than complex pictures. The same visuals are not equally effective for learners in different grade levels, and for learners with different prior knowledge.

Electracy. See *Mediacy*.

Electro-press is a method for printing. The system functions like a copying machine but it has “magnetic ink” instead of a coal-based powder. This gives a better print quality. A computer gives impulses to a number of diodes charging the drum. The charged ink is attracted to parts of the drum and it is possible to print single pages or sheets.

Electronic media provide an increasingly important supporting role. Typical services and products include books with machine-readable sections, modular material, audio tapes and discs, video tapes and discs, mixed media productions, personal computer software, authoring languages to enable teachers to

prepare their own material, and on-line computer-based training.

Electronic publishing. Traditionally publishers and booksellers have been working with books. Books are distinct products. We can hold them in our hands. We can use them when we like and as often as we like. Regardless of the content, fiction or non-fiction, the book is still a product. Only a small part of what you pay for a book is the cost of the actual content. Products are gradually replaced by “content-services,” that is, services to give people the entertainment, information, and news they want to have in specific situations.

Electronic revolution. At the end of the 1960s the “electronic revolution” was announced. The book was said to disappear and would very soon be replaced by new electronic media. During the first years of the 1970s publishing houses throughout the world were hit by severe crises. After more than 500 years the printed word is still alive and will certainly be so for a long time but together with other carriers of information and partly in other formats. We now have “on-demand-publishing” where only a printer linked to a computer prints the information needed at a specific occasion. Most of the information needed can be read on the screen and might never be printed.

Elegant design must be reduced to its essential elements and each element reduced to its essential form. See *Graphic design genus*.

Element connectedness principle. See *Connectedness principle*.

Elementary colours are black, white, yellow, red, blue, and green. See *Natural Colour System*.

Elements are all the parts of a finished design. Together they make the whole.

Ellipsis. An ellipsis (...) is normally used to indicate that a part of a text is missing in a quotation.

Em is the square of the body of type. See *Dash*.

Em dash (—). See *Dash*.

Em rule (—). See *Dash*.

Emblem books are illustrated books printed in Europe during the 16th and 17th centuries. They contain emblematic images with explanatory texts. Many thousands were printed throughout Europe and exercised a huge influence on literature and the visual arts. See *Alciato*.

Emblem is a symbolic picture with an accompanying text. Emblems developed in the sixteenth century and enjoyed an enormous popularity for the next 200 years or more. Emblems influenced celebrations and festivals, painting, poetry, rhetoric, and writing. See *Alciato*.

Emotions. Visuals with an emotional content support and extend the attitudes that we already have. Pictures will usually not change our attitudes, but they make us more convinced that we already hold the “right” views. Emotions and moods are readily conveyed with onomatopoeic combinations of graphical symbols. Visuals may express *relationships* between people. See *Colour and emotions*.

Emphasise. In order not to confuse the readers, it is important to establish a consistent system for how to signal emphasis. Use bold and italics for emphasis sparingly; too many emphasised words may reduce the emphasis.

Emphasis is used to attract or direct attention or dramatize certain points within a visual. A dark dot in a light field, and a jog in a straight line are two good examples of emphasis. These contrasts attract attention. Emphasis may also be used to direct attention, and to keep attention, or dramatize certain points within information materials. See *Emphasis in layout*, *Emphasis in pictures*, *Emphasis in signs*, and *Emphasis in text*.

Emphasis in layout. Elements like headings, photos, drawings, and information graphics attract attention and are often the entry point into a page in a newspaper. Size and placement of such elements influence how the reader will actually read. Many readers may jump over too large pictures and never look at them at all. The competition for our attention is usually very fierce in commercial arts and in advertising. Thus *discontinuity* is often used intentionally to attract and even to hold attention of the viewers. See *Emphasis in text*.

Emphasis in pictures. Emphasis is used to attract or direct attention or dramatize a certain point within a visual. Many different elements in a visual can cause emphasis. Such examples are: Areas of colour, areas of shading, arrows, change in size, circles or ovals around objects, colour, colour against no colour, complexity, detail against no detail, directionality, imbalance, implied motion, isolation, letters in pictures, light against dark, line drawings in photos, line intersections, lines, position or

placement of elements, reducing details, repetition, stars, tonal contrast, variation out of context, and words in pictures.

Emphasis in signs. Warning signs must have a high contrast relative to their background. Informative words shall be used for signals such as “Danger”; for descriptions of a hazard such as “Shallow water”; and for specific actions that should or should not be performed, such as “No diving.”

Emphasis in text. There are a several possibilities to emphasize elements in typography. We can use boldface, colour, italics, key words in red, light against dark, small against large, and underlining key words. In order not to confuse the readers, it is important to establish a consistent system for how to signal emphasis. Boldface or italics should normally not be used for continuous text, but for emphasis of parts of a text. The use of underlining and all capital letters should be restricted to headings and titles, if they are used at all. Usually bold and italics are quite sufficient. Underlining in the middle of a sentence makes the line below more difficult to read. Shaded and outline letters should be avoided. There are a few other possibilities to emphasize paragraphs in texts, such as adjunct questions to relevant information, and statements of objectives for emphasis.

En dash (–). See *Dash*.

En rule (–). See *Dash*.

Encoding–decoding model. According to the *encoding–decoding* model the sender is an encoder constructing “meaningful” texts, such as information sets. The receiver is a decoder, and is assumed to accept, negotiate or oppose the intended

meaning. This model marks a paradigm shift to earlier traditions.

Enhanced high low bars is the name of a kind of schematic picture. See *Bar charts*.

Enrichment theory. See *Perceptual learning*.

Entertainment and leisure, representations close to reality might be good choices. For instance, it could be exciting to “walk around” among the actors in a holographic film in stereo and realistic colour. For information and education, too much realism in the representations would make it difficult or even impossible for the viewer or learner to identify the essential learning cues. On the other hand, too little realism would also be a poor choice. The information is inadequate.

Entry term, or *headword*, is the first word in the explanation of a term in a glossary. See *Glossary*.

Environment design. See *Design science*.

Environmental literacy. Environmental literacy is essentially the capacity to perceive and interpret the relative health of environmental systems and take appropriate action to maintain, restore, or improve the health of those systems. Levels of literacy are generally assumed to exist but are not often defined. With respect to environmental literacy there are three proposed levels: 1) Nominal, indicating ability to recognize many of the basic terms used in communicating about the environment and to provide rough working definitions of their meanings. 2) Functional, indicating a broader knowledge and understanding of the nature and interactions between human social systems

and other natural systems. 3) Operational, indicating progress beyond functional literacy in both the breadth and depth of understandings and skills. These three levels of literacy; nominal, functional, and operational, could also be used in other kinds of literacy.

Environments. See *Computer based training environments*.

Episcope. An episcope is a device capable of projecting opaque documents, such as text and pictures on paper, or small objects.

Episodic memories are memories of specific things we have done, seen, heard, felt, tasted, and so on. They are tied to specific contexts. See *Memory*.

Esoteric jargon and impenetrable jargon can be perceived as incomprehensible by the uninitiated. Since readers who do not know the code are left out, its use poses the risk of “one-way only” communication, and has no value outside of initiated circles. We find it unsettling when experts speak down to us; it puts us into a defensive frame of mind, and may even cause us to become obstinate. Interaction analysts describe this as a “You’re OK, I’m not OK” reaction. However, what we should be striving for is a “You’re OK, I’m OK” situation.

Etching. The image is scratched in a flat print plate covered with a layer of an acid-resistant coating, like wax. When the plate is placed in an acid solution the lines are cut, or etched, into the metal. By varying the time for the etching process, it is possible to decide the thickness and blackness of the lines. An etched line has blunt endings. The method of etching has been

known since 1523. Graphic artists mainly use this method as a fine arts technique.

Ethics. As a rule the information designer must respect copyright as well as other laws and regulations that are related to design, production, distribution, storage, and use of information materials. This concerns the use of artwork, illustrations, logos, lyrics, music, photographs, specific sounds, symbols, text, and trademarks. It is also very important to pay respect to different ethical rules, media-specific ethical guidelines, and honour all business agreements.

Ethos is the way in which the senders present themselves. This may be done directly by the senders telling something about themselves, or indirectly by the way in which the senders act or appear physically. Ethos may evoke feelings of trust in the sender, as well as distrust. Ethos indicates whether the sender is familiar or not, and the relation the sender has to the receiver, for instance, friendly or formal.

Event schemas organise our conception of the content, and of the sequences of events. See *Long-term memory*.

Events. Action, humor, drama, violence, time displacement, parallel action, metaphoric descriptions (symbolic actions), and change are all examples of events that may be the main content in visuals. It is known that pictures showing events usually are perceived more interesting and more effective instructional materials than static pictures. Obviously an activity is best shown in moving pictures.

Everyday graphics are used for information about the content in packages, e.g., with food. Contrary to the producer of news graphics, but in conformity with the producer of posters, the producer of everyday graphics often has time enough to plan and design the messages in an optimal way. However, the space is often very limited for everyday graphics.

Everyday life. A well-designed information material makes everyday life easier for people, and it grants good credibility to the senders or sources.

Execution of visuals. Informative pictures should always be designed so they are easy to read for the intended audience. The goal should be *clarity of communication*. Basic elements (dots, lines, areas and volumes), size (picture, subject, depth), shape (external and contour), colour (hue, value, gray scale, saturation and visibility), contrast, texture, light (outer and inner orientation), emphasis, composition (organization, balance, centres of interest and direction), perspective (depth, angle of view, levels), technical quality, pace, speed changes (slow, fast), editing, zooming (in and out), panning, visual complexity and visual effects are examples of pictorial factors and pictorial components.

Execution. See *Image execution*.

Execution perspective or *design perspective*, of message design and information design includes 1) text design, 2) image design, 3) shape design, 4) sound design, 5) light design, 6) spatial design (expo and event), and 6) time design (the ability to deliver information when the user needs it). This concept has also been said to include views such as craft, manufacturing, technology, theory, and users. See *Context perspective*.

Excelsior is a classical newspaper typeface.

Expanded time dimension. See *Pictorial dimensions*.

Expanded type has been regarded as positive light, and providing room to breathe.

Experience. Using more than one sense can enhance our experience, perception and understanding of a message, and make it easier to form a conceptually complete model of a topic. A general view can make it easier to understand detailed information. Multiple perspectives are also important. Rain, for instance, is not just an abstract meteorological phenomenon, we can feel it, it tastes and it sounds a special way, and it brings life to plants and animals. Many media can only convey limited “aspects” of the total information. Multimedia allows us to use all our senses and also to view information from different perspectives, which can improve understanding. Furthermore, the interactivity of computer-based media may inspire a passive observer to become an active explorer. Whether we actually succeed in finding the information we need is dependent on how interested we are in finding it, where and when we look for the information, associations we make, graphic design, presentation technique, and our experience.

Experience-design includes parts of the areas architecture, exhibit design, game design, interactive multimedia computing, storytelling, theatre, visual design, visual literacy, and website design.

Experience-dimension is based on the functions of human perception and our possibilities to experience the contents of

the actual message. In many information systems, experience of information is somewhere between the terminal points “directed and intended” and “free and associative.” Movies and TV-programs, video-programs, expert systems, hypertext systems, daily papers, interactive video-programs, hypermedia-programs, computer games, music, fiction, and poetry can be used for illustrating the “Experience-dimension.” Moving up the scale the systems provide more free and associative.

Experiential learning. The process of active learning and real work experience is sometimes called experiential learning. Learning is facilitated when it primarily is based upon direct confrontation with practical, social, personal or research problems. The role of the teacher is to facilitate learning.

Expertise. A source with a high degree of *expertise* may be described with words like *able, accurate, authoritative, experienced, informed, intelligent, knowledgeable, skilful, and trained*. The opposite words would describe a source with a low degree of expertise.

Explicit memory. See *Declarative memory*.

Exploded drawing, exploded view drawing, is a diagram, picture or technical drawing of an object. It shows the order of assembly of various parts, or their relationships. The parts are separated or suspended in space. Exploded view drawings are used in catalogues, and manuals. See *Drawings*.

Exploded pie chart is a schematic picture. See *Pie charts*.

Exploded view drawing. See *Exploded drawing*.

Exponential curve is a schematic picture. See *Graphs*.

Expressionistic style is a pictorial artistic style, an artist's rendition of the subject that leans heavily towards abstraction.

Extended refer to horizontally wide type designs.

External access. The information designer is obviously not responsible for how the intended receivers store their information materials in binders, shelves, and archives or in computer based digital systems. However, when possible, the information designer should design for "easy external information access." Thus information materials should fit the main systems for storage. See *Digital documents, Information access, Standard paper, Technical documentation*.

External context is the entire communications situation, i.e., senders and their intentions for the picture and receivers and their circumstances (e.g., time available). It includes *Close context* and *Social context*. See *Context perspective*.

External contour. The visual's external contour should be blurred and unclear so the visual fades in and out of the background and never clear enough to stand out against the background. A printed image should fade in and out from the (white) page and a projected image should fade in and out from the (dark) screen.

External representations are physical configurations such as various information materials. There are two types of external representations. *Descriptive representations* include mathematical equations, spoken and written texts. *Depictive representations* include physical models, pictures, and sculptures.

External shape. The picture area in drawing, painting, and still photography can have any shape and any orientation. Most pictures, though, are cropped and published in square or rectangular formats. However, the visual's external shape should actually rather be "free-form," round, or oval, and not delineated by straight lines. Perception of shape is influenced by contextual variables.

External textual structuring refers to the techniques used to structure text with linguistic, spatial, and typographic cues. The techniques include the use of blocked text, horizontal lines to divide blocks, italicized text, and bold text.

Eye movements. In normal reading the text within foveal vision comprises an area of seven to ten letter spaces. Outside of the fovea the number of sensory cells decline. Here the retina is less sensitive. However, these sensory cells are important for our "peripheral vision," which is especially sensitive to movement and brightness, both highly relevant to the detection of any approaching danger. Our eyes never remain still. They tremble at a frequency of about 30–90 Hz. The eye alters its fixation point constantly. It also makes constant small jumps. We constantly "scan" the things we look at. The pattern for eye movements and fixations depends on what we wish to see or are told to see in a picture. There is a positive correlation between the number of fixations and intelligence and visual learning—Looking at pictures is a "natural" way of free exploring. Only certain image elements capture our attention and interest. Informative parts of a picture attract more fixations than less informative parts. Different kinds of pictures give rise to different kinds of fixations and intelligence and visual learning.

Eye-level perspective, or *normal perspective*, is a level perspective. Objects are usually viewed straight from the front and at the same level as the viewer. This “normal picture angle” and the normal way of viewing is the least obtrusive angle. See *Line-based positional perspectives*.

Eyes are variables that will influence our perception of individuals in photographs. Individuals shown with closed eyes are viewed more negatively than those shown with open eyes.

F

F series paper. In Sweden the ISO system of A, B, and C formats is supplemented by adding D, E, F, and G formats.

Face is the printing surface of type; also, any particular style of type.

Faces. Messages including visuals are preferred by most subjects and they attract attention. Generally speaking, *humans*, especially our faces, are the kind of content that will get maximum attention in images.

Facial expression is a variable that will influence our perception of individuals in photographs. Individuals smiling are viewed as positive and individuals frowning are viewed as negative.

Facilitating attention. There are always far more stimuli than we can ever notice. Fortunately most stimuli remain unknown, unseen, and unheard of. One of the information designer's first problems is to *catch* the attention of the members of the audience. Then it is up to the designer to *hold* or keep their attention. Any information material must constantly *re-draw* the attention in order to hold the interest of the viewers alive. In order to get and to hold attention it is important that information materials facilitate human attention. There is a close relationship between guidelines aimed at providing emphasis and guidelines aimed at facilitating attention. Emphasis in a message will result in attention to that specific message.

Facilitating attention to colour. In order for colour to be used as efficient cues and attract attention we can use a few ac-

centing bright and bold colours, and use colour to clarify the structure of a text.

Facilitating attention to layout. Layout and typography should be transparent and not stick out and cause any specific attention in information materials. However, sometimes, it may be important to direct attention to specific parts within information materials. We can put pictures as close to the relevant text as possible, and use arrows, bullets, icons, margin notes, repetition, underlining, and/or white space to highlight the relevant information.

Facilitating attention to pictures. Pictures may be used to *attract attention, gain attention, get attention, hold attention* and *maintain attention* to a given material or a given subject. The receiver must see or rather “discover” each picture and actually read the message in an active and selective way. Good captions will direct attention within pictures.

Facilitating attention to symbols. The receiver must be able to see or rather “discover” symbols. This is especially true for different kinds of warning signs. We can combine colour with shape and position, make warning signs with adequate reflectance, good lighting, and high contrast to their background.

Facilitating attention to text. In order to attract and hold attention to texts in information materials we can make the structure of a text as clear as possible, set text bold and large enough, use headings to make the subject matter readily apparent, and indicate the relative importance of different items in the document.

Facilitating interpretation. See *Facilitating mental processing*.

Facilitating learning. Any graphical message should be legible, readable, and also well worth reading for the intended audience. Any audial message should be audible, distinct, and also well worth listening to for the intended audience.

Facilitating memory. There is a close relationship between guidelines aimed at providing simplicity and guidelines aimed at facilitating perception, processing and memory. Simplicity in a message will result in easier and more effective perception, processing and memory of that message.

Facilitating memory for pictures. In order to facilitate memory for pictures we should put pictures as close to the relevant text as possible, co-ordinate design of learning materials with a theory of meaningful learning

Facilitating memory for text. In order to facilitate memory for text we should present only a limited number of information elements, present text and illustrations in close connection, use cuing to highlight ideas.

Facilitating mental processing. There is no direct correspondence between groups of letters, words, sentences, paragraphs, texts, and reality. Understanding the concepts that words represent in various specialist areas and sub-cultures may be difficult or even impossible for all non-specialists. Thus the information designer needs to know the audience. Simplicity in a message will result in easier and more effective perception, processing and memory of that message. Design has

the unique capacity to shape information by: 1) Emphasizing or understating. 2) Comparing or ordering. 3) Grouping or sorting. 4) Selecting or omitting. 5) Opting for immediate or delayed recognition, and 6) Presenting it in an entertaining fashion. In general one can state that information should be as simple, clear, and unambiguous as possible. However, in any presentation, information can be enriched with a wealth of details.

Facilitating perception. We organize and analyze information that we have paid attention to. Colours, illustrations, images, lines, pictures, sounds, symbols, texts, and words should be integrated in such a way that they can be interpreted as a meaningful whole rather than a number of individual elements. Perception of two- or three-dimensional representations entails fast, parallel, simultaneous, and holistic processing. See *Perception*.

Facilitating perception of colour. Depending on age, culture, gender, and profession, there are different subjective reactions to colour. There are likes and dislikes of colour, based on general as well as personal associations. Colours should be used with care. We should consider that many people are colour-blind, not focus on specific colours as always best, and not use more than three or four text colours on the same page, screen, or slide.

Facilitating perception of layout. To aid perception we should avoid too short and too long lines, make sure that distribution of space reflects relationships, and use colour, orientation, pattern, shape, size, texture, and value to show that objects belong together.

Facilitating perception of pictures. In order to improve the reading value of the pictures we should provide a good contrast between figure and ground in pictures, consider cultural differences, and use photographs showing people.

Facilitating perception of text. In order to improve the reading value of the text we should avoid irrelevant information and distracting jargon, provide text with a rich language for pleasant reading, and use a list of contents to create pre-understanding.

Facilitating processing of colour. In order to facilitate the processing of colour we should use colour coding in a consistent way, but limit the number of colour codes. We should also Find out likes or dislikes of colour among the intended audience.

Facilitating processing of layout. In order to facilitate the processing of layout we should avoid inconsistent use of typography, use illustrations that are relevant to the content in the text, and use captions to anchor interpretations of pictures.

Facilitating processing of pictures. In order to facilitate the processing of layout we should use pictures that are relevant to the content of the text, use line drawings when study time is limited, and use realistic versions of artwork when unlimited study time is allowed.

Facilitating processing of text. In order to facilitate the processing of layout we should divide the text into sections, subsections, and paragraphs to avoid too large masses of text, use a variety of examples and non-examples, and provide the

time that is necessary for the receivers to read, interpret and understand the message in the text.

Facilitating understanding. In order to facilitate understanding we should adapt the message to human attention and perception in order to facilitate interpretation and learning. We should edit the message for better comprehensibility and easier understanding.

Facts is a term for a group of information materials in the category *Factual information*. The objective of facts is for the receiver to comprehend, i.e. to succeed in understanding the meaning of something and possibly, but not invariably, forming her/his own opinion about it. Examples of information areas or themes for facts are: 1) Information on current events, historical events, future events. 2) Information on geographic location; where something is, the best route to get there. 3) Information on goods and services, prices, dimensions, delivery times, delivery terms, performance etc. 4) Information on organisations, their addresses, bank giro account number, managers, complete names, legal status, postal giro account number, business hours etc. 5) Information on times. What time does the bus, ship, flight, train depart? What time does the show begin? How much time do I have left on the parking meter? 6) Safety information, e.g. evacuation from a ship, aircraft, hotel, public building etc. in the event of a fire or other hazard.

Factual content. “Realistic pictures” can provide reasonably objective documentation of an object or a product.

Factual content statistics. Numeric data are often used to illustrate situations such as relationships between variables and

parts of a whole. Data can be presented in many formats. Graphical formats include comparisons of numbers, lengths, areas, volumes, positions, and also comparisons of different combinations of these variables.

Factual information is a term for a category of information materials. Supplying information is the primary task of a large number of information materials. We can use some of the following information components in developing information material: addresses, article numbers, bank giro account numbers, bar codes, dates, declarations of contents, delivery terms, descriptive texts, drawings, indices of various kinds, informative graphics, informative texts, informative texts, ISBN numbers, ISSS numbers, lists of various kinds, maps and plans, narrative texts, non-fiction texts, postal giro account numbers, price information, product numbers, prose, registration numbers, schematic pictures (diagrams and graphs), serial numbers, subject indices, summaries, symbols, tables. The group could conceivably even be referred to as ‘facts’ or just ‘information’, but this would be needlessly confusing, as the term ‘information’ is used in so many different contexts and in so many different ways. Factual information is always more comprehensive than brief, simple messages. See *Facts, Descriptions, Reports*.

False friend. A “false friend” is a word that looks almost the same in two languages, but has different meanings.

Familiarity. Common typefaces are easier to read than uncommon typefaces. Furthermore serif typefaces are often considered to be easier to read than sans serif typefaces, except for small letter sizes. Common font families like Baskerville, Ber-

ling, Bookman, Garamond, New Century Schoolbook, Palatino, and Times New Roman can be used successfully for the body text in books and reports. Modern newspaper typefaces include Gulliver, Stone, Swift, and Utopia. These are all serif typefaces. Like Times New Roman they have large x-heights and good legibility. Helvetica typefaces may be the most widely used among the sans serif typefaces in the world today. In printed materials Helvetica may be used for headings, labels in pictures, captions and tables.

Families. See *Design science*.

Family literacy is an educational method providing parents and children with family-focused and long-term educational services. A literate family tends to be a stronger family with children more likely to be successful in school.

Fantasy images. Fantasy is an imagined, generally pleasant, event or object. We create fantasy visual images by juxtaposing previously acquired combinations in new ways. Using our imagination, we can generate mental visual images of things we have never seen nor experienced before. Fantasy fulfils a wish or satisfies a desire whose ultimate origin is subconscious.

Farsightedness. See *Myopia*.

Fenton. The British photographer Roger Fenton (1819–1869) was one of the first war photographers. He documented the Crimean war in 1855.

Ferro-electric Liquid Crystal Display. See *FLCD*.

Fibonacci numbers: 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, and so forth. This is a close approximation of the golden quota ($8/5 = 1.6$).

Field study is what researchers do to create or approve facts in real settings. Field studies crosscut disciplines, fields and subject matters that have the power to mediate experiences in a concentrated format. Field studies are considered to be an instrument for qualitative research that could fulfil a number of research styles. A field study creates learning situations about complex instances through extensive descriptions and contextual analyses. It could record a great deal of data from observations of long duration that are presented in a straightforward and compressive format. The reader could either get a recommendation of the insights or get insights that could be transformed into similar situations.

Fields refers to clearly delineated activities, often addressing specific target groups, in which access to a certain type of information is important. The following are examples of some important (subject) fields: administrative information, consumer information, economic information, geographic information, product information, public health and pharmaceutical information, social information, technical information, tourist information. We could obviously mention even more fields in which information materials may be important. Different kinds of information products and, accordingly, different media can be used in each field.

Figurative representations include two groups, visuals and graphic symbols. Visuals include three-dimensional images,

photographs, realistic drawings, and schematic drawings. Graphic symbols include pictorial symbols, abstract symbols, and arbitrary symbols. See *Representation*.

Figure and background principle. See *Figure and ground principle*.

Figure and ground principle is also known as the *figure/ground principle*, *figure and background principle*, and the *theory of figure and ground*. We select some elements in a picture as the *figure*. The remaining elements constitute the *background*. This is one of the simplest perceptual organizations.

Figure stone. See *Image stones*.

Figure-ground perception. Figure-ground perception is a fundamental aspect of field organization. It is however, not always referred to as a *Gestalt law*, rather as a “figure-ground articulation.” The Danish psychologist/phenomenologist Edgar John Rubin presented his work on figure-ground perception 1915/1921. This was before Max Wertheimer presented the *Gestalt laws*. See *Rubin*.

Figure/ground principle. See *Figure and ground principle*.

Filippo Brunelleschi (1377–1446) was an Italian architect and engineer. He figured out a practical method that made it possible to produce accurate representations of a scene from a precise location and a definite point of view. Around 1420 he made public demonstrations of optical linear perspective. Linear perspective spread throughout Western Europe. It became

standard studio practice and opened up for illustrative drawings. See *Renaissance*.

Fill-in blanks. Fill-in blanks () can be used in assignments, and in lists of various kinds, for people to mark their choices.

Film media are media projected in some device and viewed on a screen or similar device. Filmstrips, different kinds of movies, transparencies, microfilm, microfiches, amateur film, overhead pictures, and widescreen films are examples of film media.

Filter. Thousands of alternatives are available to a sender wishing to transmit a rendition of some reality to receivers. Senders always utilize a “filter” and quality checks before selecting one of the many available text and picture options. The choice is based on the sender’s subjective opinions. The sender selects the option believed to be the most efficient for each purpose and each transmission situation. The selected pictures/texts are then edited in one of many ways for the purpose of enhancing reception impact. Thus, a selected, edited version of reality is transmitted to receivers. In mass communications, message reception can be affected in countless ways. For example, television reception may range from very bad to very good. Different viewers also perceive the same text and/or image in different ways, since there are always great inter-individual differences in perception.

Final design. The final design represents the outcomes of each specific design process, such as products, services, processes, and systems. On a theoretical level the intention of the overall design process might be the same regardless of the specific design area.

Finance and business markets are time critical. Such services demand “real-time” communication. They may be available on demand or include an alerting service. Typically these services will be concerned with financial matters such as stocks and shares, commodity trading, etc. Non-time-critical services will include a series of browsing and alerting services similar in purpose to newsletter-type publications. Such media as videotex, teletext, Internet, Intranet, electronic mail, audiotape, and digital discs may supply them. In-house publications such as manuals will be increasingly presented in electronic form, with greater interactivity and also quality of reproduction and presentation.

Financial capability. See *Financial literacy*.

Financial capability. See *Financial literacy*.

Financial literacy, *financial capability*, is the ability to understand finance. It refers to the set of skills and knowledge that allows an individual to make informed and effective decisions through their understanding of finances. See *Numeracy*.

Financial literacy, or *financial capability*, is the ability to understand finance. It refers to the set of knowledge and skills that allows an individual to make informed and effective decisions through understanding of finances. In 2003 the Organization for Economic Co-operation and Development (OECD) started a project to improve financial education.

Finding information. Computer-based information systems have made it easier to find information, but there are also factors that can make it harder to find exactly the information we

are interested in. One reason is that we associate words in different ways, and we give words different meanings depending on their contexts. We may find a lot of superfluous information when searching for documents in a bibliographic database. It is almost impossible to know that we have found everything of interest to us after a search in a hypermedia or multimedia system. The information we want may be located in many different nodes in the web. It is often impossible to scan every information item in the database. It is desirable to be able to execute search questions as a complement to browsing and navigation. In addition, it is important that the producer of a multimedia information system carefully plans which information to communicate, and how to communicate it.

Firm rules. See *Design motto*.

First line indents are the distance between the beginning of the first line in a paragraph and the left margin. They are often used for the running text in books. First line indents improve legibility, as well as comprehension of printed materials. Indenting of every sentence will, however, slow down reading speed. See *Indents*.

Fisheye perspective. See *Five-point perspective*.

Five-point perspective, or fisheye perspective, has four vanishing points placed in a circle and one in the centre. This is the curvilinear equivalent of one point perspective. Fisheye lenses are ultra wide-angle lenses that produce strong visual distortions. These lenses are used to create wide panoramic or hemispherical images.

Fixation. See *Eye movements*.

Fixed interfaces. Many products have “fixed interfaces” in e.g. instruments and instrument panels. Simple characters, symbols, or words are impressed or printed on the product. They can be printed on labels or signs. Some messages from a fixed interface are brief messages, whereas others comprise instructions requiring action in several steps. Fixed interfaces are gradually being superseded by graphic interfaces in many products. See *Graphic user interface, Interface*.

Flatbed scanners. Professional flatbed scanners or laser scanners are large scanners, with high resolution, working with colour or black-and-white.

Flattened type has heaviness, inertia, self-satisfaction, and solidity.

FLCD, Ferro-electric Liquid Crystal Display, is a flat screen with liquid crystals. The ferro-electric crystals work tens of thousands times faster than the normal LCD. They give better contrast and use less energy. See *LCD*.

Flexography. In flexography rubber or plastic plates on cylinders are used. Low costs and solvent inks to speed ink drying are making inroads into book printing, magazines, and even newspapers. Flexography is being used extensively in heat-transfer printing for textiles. It is also a method for production of packaging materials, labels, and wallpaper.

Flicker threshold. Movie film usually uses 24 pictures and PAL-television 25 images per second. This is just below the so called “flicker threshold” which lies at about 27-28 images per

second. At higher picture frequency the eye can no longer keep up. NTSC-television uses 30 images per second and thus gives a more stable television-image than PAL-television.

Floor plans and layouts are schematic pictures. See *Plans*.

Flow chart is a schematic picture. See *Diagrams*

Flow diagram is a schematic picture. See *Diagrams*.

Flow map is a schematic picture. See *Maps*.

Flow visualization is the art of making flow patterns in air and water visible. The flow processes are shown in computer models. See *Visualization*.

Flushed left text, or *unjustified text*, has exact spacing between letters and between the words. It keeps the visual rhythm constant. This aids reading, especially for young, inexperienced and poor readers. Results from reading experiments of justified and unjustified texts indicated a significant increase in reading time for the groups that read justified texts. There were, however, no differences in comprehension. Whether a text is justified or unjustified causes no significant difference in search time and comprehension of the information content for advanced readers. Until recently most publishers regarded the use of anything other than justified text as unprofessional. Today, however, unjustified text is commonly used for running text in books, magazines, reports, and in some newspapers.

Flushed right texts can be used for captions that are positioned to the left of the pictures, and for tables of contents. This is, however, only possible when the line length is short. Regard-

less of justification system the ends of sentences should be determined by syntax rather than by an idea of a set width of line.

Focus groups. Members of the group of intended users may form one or more focus groups. The focus groups should be asked to discuss and review the information material at the various steps in the production process. Focus group sessions may be helpful in answering questions of how and why people behave as they do, and how they understand the subject matter in an information material.

Folder consists of a single sheet, usually printed on both sides. It may be folded two or more times and used as a piece in advertising.

Font, *font of type*, is a complete assortment of characters of the same style and size. Some fonts (such as Zapf Dingbats) are not alphanumerical. However, in computer manuals the word *font* is sometimes used to mean *typeface*, which is confusing.

Font hinting refers to editing typeface outlines to available pixels.

Font of type. See *Font*.

Footers may appear at the bottom of every page. They should provide information that will help the reader navigate in a document. Footers often carry page numbers. There may also be footnotes. See *Headers*.

Footnotes are placed at the bottom of the page or at the end of the chapter or the article. Usually a smaller type size or a different typeface is used. A horizontal line can be used to separate

the footnotes from the running text. When there are two or more columns on a page footnotes should be placed at the end of the paper.

Forced perspective is a *line perspective*. It is a form of optical illusion. Forced perspective is used in architecture, film, photography and video to manipulate human visual perception. It is used to make an object appear to be larger or smaller, to be closer or farther away than it actually is. Producers use scaled objects and manipulate the correlation between them, the camera or viewer, and the vantage point.

Forgetting is the process through which information in memory becomes inaccessible, either because the information is no longer stored or because it is stored but is not at that time retrievable. Forgetting is rapid at first and then gradually levels off. This process may be increased by interference from other material, either learned beforehand or subsequently. The amount of forgetting increases with the amount of interfering material and with its similarity to the material being remembered. People tend to remember what they regard as most important; they typically operate by attempting to reconstruct the incident using their existing knowledge, with the result that they may recall what would have been expected instead of what actually occurred.

Forgotten illustrations. Illustrations in textbooks are often “forgotten” by students as well as teachers; therefore it is important for editors and information designers to clearly instruct the learners to make good use of the pictures.

Form and function. See *Function can take any form.*

Form follows function. See *Function can take any form.*

Formal balance has total symmetry and it is felt to be static and harmonious. It may, however, also be boring. Composition can be used to direct the viewers. See *Informal balance.*

Format. See *Image format.*

Format index. It is difficult to compare pages and pictures, especially in different media. To objectively compare formats of pages, papers, and pictures we can use an index. Such an index may be calculated as the height/width x 100. All wide formats get index numbers below 100. All square formats get index 100. All vertical formats get index values over 100. This is regardless of how large the individual pages, papers, or pictures are.

The format index can be used to compare pages and papers (as a *page format index*, or a *paper format index*). When we use A-series papers horizontally they have index 71. When we use these papers vertically they have index 141. When we use US-letter papers horizontally they have index 77. When we use these papers vertically they have index 129.

The format index can be used to compare pictures and projected images (as a *picture format index*). The horizontal golden ratio format has index 62, and the vertical golden ratio format has 162. A projected slide has index 65, a PP 75, and an OH 78.

Foundation. See *Information design foundation.*

Four-field diagram is a schematic picture. See *Diagrams.*

Four-field matrice is a matrix. See *Matrices.*

Four-point perspective, *infinite-point perspective*, is a *curvilinear perspective*. It uses curving perspective lines to approximate the image on the curved retina in the bottom of the human eye. It is the curvilinear variant of a two-point perspective. A four-point perspective image becomes a panorama that can go to a 360 degree view and beyond. See *Line-based positional perspectives*.

Fovea, the region of the retina that gives us sharpness of vision. See *Eye movements*.

Fox Talbot. The British inventor William Henry Fox Talbot (1800–1877) made a photomechanical reproduction in the 1840s. His new technique led to the photo glyphic engraving process, which in turn led to photogravure. As a photographer Talbot contributed to the development of photography as an artistic medium.

Fragments. We can easily comprehend fragments of individual events from around the world because television is a suitable choice for supplying fragments out of context, often without any real value. Television in the U.S. has made entertainment the natural form for all presentations of reality.

Framing is a variable that will influence our perception of individuals in photographs. The larger a person's face appears in a picture, the more positively our perception of that individual is. A close-up headshot of a person is more positive than a photo taken from a distance.

Free and associative experience. The only true, free and associative experience is caused by reality itself. All representa-

tions of reality introduce some kind of restriction on our experience. However, associative multimedia systems have the potential for creating a relatively free and associative experience. Computer games are an example of a medium with very free and associative experience. The structure of a computer game can vary between linear and non-linear. Navigation is often relatively unregulated, and images are common in graphic adventure games. Fiction, poetry and music, all have a very high potential for free and associative experience, since our imagination is not restricted by existing visual images.

Frequency index is the percentage of textbook pages with pictures. In textbooks for the junior level this index may be 90–100%. In textbooks for the intermediate level the index may be 50–70%, and 30–60% in textbooks for the junior high level.

Frequency polygon is a schematic picture. See *Graphs*.

Frog perspective. See *Line-based positional perspectives*.

From writers to readers. A great many people in different occupational categories are required for transmitting a message from writers to readers: people such as text and picture editors, graphic designers, typesetters, repro technicians, printers, bookbinders, stockroom staff, salespersons, order takers, bookstore employees, librarians, buyers, and administrators. The different steps involved in publishing are time-consuming and jointly represent a major expense. About ten percent of the price of a book, not including tax, usually goes to the author. Electronic publishing could change this situation to some extent. It would reduce the distance between writers and readers.

New opportunities for a dialogue could then develop in some instances.

Frontal lobes of the cerebral cortex in the brain are specialized for planning and execution of complex activities.

Frozen moment in time. A still picture is a “frozen moment in time.” It does not show what happened before or what will happen after this specific moment.

Full paragraph indents are the distance between the paragraph and the left margin. Long quotations should be distinctly separated from the rest of the text. Quotations are often indented, sometimes also on the right side. Full paragraph indents may also be used for lists and tables.

Full stop (.) can mark the end of a complete sentence. If the whole sentence is in parentheses, the full stop should come before the closing bracket. If only the last part of the sentence is in parentheses, the full stop should be outside the last bracket.

Full-tone picture. Dots, lines, and areas of solid paint build up all line-art, or “full-tone pictures.” Line drawings, schematic illustrations, maps, and business graphics all belong to this category.

Function can take any form. This phrase is an adaptation of the famous: “form follows function” which can be traced back to the American sculptor Horatio Greenough, who had used it in *Form and Function*, written in 1851. See *Leon Battista Alberti*.

Functional principles is a term for one of the four groups of message design principles. It includes six principles: → *Defin-*

ing the problem, Providing structure, Providing clarity, Providing simplicity, Providing emphasis, and Providing unity. Guidelines that are based on these principles will assist the information designer to design information and learning materials that are well suited for the intended receivers. See these terms and *Message design principles*.

Functional properties predominate in symbols. They are also more important than suggestive properties in informative and educational pictures, since their task is to convey certain information in the most effective manner possible. The objective for a picture for information may also be to convey certain emotions and arouse the viewer's interest and involvement (e.g., regarding conditions in other countries and cultures, or in past times). See *Properties of visual language*.

Functions of visuals. Generally speaking it is not possible to rank the different types of visuals. Often the type of visual that should be used must be determined in each individual case with a view to various demands on the picture and the prevailing budget framework. From a theoretical point of view, a visual can possess many different functions and effects or combinations of functions and effects.

Futharks. See *Runic alphabets*.

Futura is a common sans serif typeface.

Future media might also be capable of representing smell, which would add still another dimension.

G

G series paper. In Sweden the ISO system of A, B, and C formats is supplemented by adding D, E, F, and G formats. G5 (169 × 239 mm) and E5 (155 × 220 mm) are popular for printing dissertations.

Game design is the process of designing digital games, mainly for use in computers. This requires artistic and technical competence as well as writing skills.

Garamond. The French printer *Claude Garamond* (c. 1490–1561) focused on punch cutting, type design, and type founding. He provided a successful service to many famous publishers. His typefaces spread all over Europe, and they were often copied. Garamond insisted on clarity in design. His typefaces are considered the typographical highlight of the 16th century.

Gender roles. Old traditions may be hard to change. In the 1970s many researchers showed that media provided clear messages about specific gender roles. This is in fact often still the case. Content in many basal readers still show traditional gender roles regardless of the major changes that have appeared in public opinion.

Genera. See *Design science*.

General audience. See *Receiver groups*.

General writing process. See *Writing process*.

General writing strategy. See *Writing process*.

Generative learning. According to the generative learning model the learner generates relations 1) between the text and the learner's knowledge and memories and experiences, and 2) between the units of the text, such as words, sentences, and paragraphs. Learners will more easily recall images and concepts that they themselves generate as opposed to images and concepts generated by the instructor or generated by the learning material.

Generic concept system shows different types of hierarchical concepts. See *Conceptual models*.

Geneva is a common sans serif typeface.

Gentleman's perspective is a level perspective. It is higher than the eye-level perspective but lower than the *military perspective*.

Geometrical perspective. The placement of objects within a picture is important in geometrical perspective. This is common among traditional Japanese and Mayan artwork. Here, objects close to the viewer are shown in the lower part of the picture. Objects that are further away from the viewer are shown in the image above the near objects in the lower part. The most important figures are often shown as the highest in a composition. Objects further away may be placed on a vertical line, as steps on a ladder. This is sometimes called *vertical perspective*. Geometrical perspective is quite common in children's drawings. See *Other positional perspectives*.

Georgia is a serif typeface specifically designed for clarity, by the type designer Matthew Carter. It is similar to Times New

Roman, but it is larger at the same point size. Georgia has a large x-height and open and wide characters. Thus Georgia has good legibility on computer screens, even at small sizes. The Georgia typeface is very common for running text in documents at the Internet.

Gestalt. See *Gestalt psychology*.

Gestalt laws. See *Gestalt principles*.

Gestalt principles, or *Gestalt laws*, were introduced by Wertheimer, and were further developed by Köhler, Koffka, and Metzger. *Gestalt principles* help us organize the world around us. They are basic for the syntax in visual languages. They describe and explain the organization of perceptual scenes, and that we perceive combinations of groups of elements or objects. Each Gestalt principle is supposed to function, as long as all other things are constant. Sometimes two or even more principles apply to the same grouping of elements. When the principles agree the effect is stronger. When the principles disagree the effect is weaker, and one of them will take over. Information designers can use several of the Gestalt principles in order to make it easier for the intended audiences to interpret the messages in information materials as meaningful wholes, rather than as a number of random, individual elements. See *Area principle*, *Auditory principles*, *Closure principle*, *Common fate principle*, *Common region principle*, *Connectedness principle*, *Continuity principle*, *Contrast principle*, *Convexity principle*, *Figure and ground principle*, *Good form principle*, *Grouping principle*, *Objective set principle*, *Past experience principle*, *Proximity principle*, *Similarity principle*, *Spatial concentration principle*, *Symmetry principle*, and *Synchrony principle*.

Gestalt psychology. Early in the 20th century the three psychologists Max Wertheimer (1880–1943), Kurt Koffka (1886–1941) and Wolfgang Köhler (1887–1967) collaborated on the founding of a new holistic attitude toward psychology called *Gestalt psychology* or *Gestalt theory*. The German word *Gestalt* means form, pattern, or shape. The Gestalt psychologists believe that conscious experience must be viewed as a “whole.” The essential thesis in *Gestalt psychology* is that in perception *the whole is other than the sum of its parts*. Visual perception cannot be understood simply by analysing the scene into its elements. Instead, what we interpret depends on the relations of these elements to one another. The brain works fast and in a holistic way, and we “see the big picture.” Later we may return and attend to the separate parts. This explains why a picture may have something new to offer even when we have viewed it many times.

Gestalt theory. See *Gestalt psychology*.

Gianlorenzo Bernini. See *Bernini*.

Gill is a common sans serif typeface.

Glossary. A glossary contain explanations of all terms (including abbreviations and acronyms) that are to be defined in accordance with guidelines for the selection of terms. Explanations of terms are short and distinct, and usually without. The first word in an entry is an *entry term* or a *headword*. In this entry the entry term is “Glossary.”

Glossy is a reproduction proof of type.

Goal 1. In information design the main goal is clarity of communication.

Goal 2. Goal of communication-oriented message design should always be clarity of communication. The message must be accurately developed and transmitted by the sender and then correctly interpreted and understood by the receiver.

Goal 3. Goal of credibility, to persuade, leads to intended behaviour such as voting, buying, loving, giving, and so forth. A message that is not believed cannot persuade. A crude presentation (like a typewritten letterhead) or a “hucksterish” presentation (like the TV ads of auto dealers) may not be believed. Careful presentation may be required to overcome prejudices held by decoders.

Golden mean, or *golden section*, is a mathematical method from ancient Greece of dividing space. The proportions of the golden mean are 1:1.618. The sides in the *golden rectangle* are 3:5, 5:8, 8:13, 13:21, 21:34, etc.

Golden ratio. For centuries the proportions according to *the golden ratio* has been regarded as beautiful. It has been treated as an important “rule” in architecture, art, design, and typography. The golden ratio is an irrational number of a line divided into two segments. The ratio of the whole segment (a+b) to the larger segment (b) is the same as the ratio of the larger segment to the shorter segment (b/a): $(a+b)/b = b/a$

The principle of the golden ratio is comparable to the “Fibonacci numbers”: 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, and so forth. This is a close approximation of the golden quota ($8/5 = 1.6$). A golden rectangle therefore has sides of approximately these

proportions (8/5). Being multiplied by 1.62 enlarges any such rectangle, and being multiplied by 0.62 reduces it.

The golden ratio has been used in the past to estimate suitable levels for headlines in a document. The size of body-type is multiplied with 1.62, and then rounded off. If the body-type is ten Didot points, and there are four levels for headlines in the document, the following sizes are adequate: 10, 16, 26 and 42 Didot points. However, in one study subjects rated headlines designed according to the golden ratio as the lowest alternatives. In the alternative that was considered best the headlines were 12, 18, 24 and 30 points. Furthermore the golden ratio rules are not at all in accordance with the views expressed by subjects who took part in experiments with design of book pages. In this study subjects designed the “most harmonious page.” For 170 subjects the mean for the “most harmonious page” is 22.9 cm high and 16.7 cm wide. A page designed according to the golden ratio with the same height (22.9 cm) should be 14.1 cm wide, which is 15.6 % less.

Golden rectangle. See *Golden ratio*.

Golden section. See *Golden mean*.

Good advice is a term for a group of information materials in the category *Instructions*. Good advice provides a simple explanation of how to perform various practical tasks. Newspapers, magazines and some TV programs offer good advice. They give us e.g. tips on how to arrange flowers, how to diet, how to build furniture and how to use makeup according to the latest fashion trends.

Good continuity. See *Continuity*.

Good design is simple, bold, and direct. It ensures that significant design elements will be noticed by removing insignificant elements wherever possible. Good design provides rational, functional aesthetics, as well as effective and efficient layouts for all media.

Good documentation implies very good comprehensibility and low cost, as well as ready accessibility when it is needed, and only then in fact. Poor comprehensibility diminishes the receiver's confidence in the sender of the documentation, and heightens the risk of unsound decisions. Many good suggestions may be rejected because the people who determine their practical merit simply do not understand what the suggestions call for.

Good figures in the sense of clarity, simplicity, regularity, and stability, are closed and exhibit a continuous contour. A given contour can belong to only one of the two areas it encloses and shapes. The contour shapes are perceived as a figure. Reversible figures lack sufficient cues as to which side of a contour is figure and which is the background. This is often used to create illusions.

Goodform principle is also known as the *principle of good form*, *law of good Gestalt*, and the *law of Prägnanz*. Prägnanz is a German word, meaning conciseness, orderliness, or succinctness. There is a need for the mind to have a general understanding of a situation. According to the *principle of good form* we have a tendency to perceptually group elements together if they form a pattern that is orderly, regular, and simple. This

principle demonstrates that people eliminate complexity and unfamiliarity.

Good information material has a distinct structure; it is relevant, legible and readable by the intended target group. Good information materials meet stringent demands on good economics, good contents and good linguistic and technical quality. Different information materials may have multiple functions and more than one objective all at the same time. Good information materials make everyday life simpler for receivers who need the specific information and provide senders with a good economic return and good credibility.

Good information quality can be defined as the degree of congruity between the sender's and the receiver's subjective perceptions of the information, as well as of the reality that the information represents. By investing resources in improving the quality of information, we can achieve better product and project quality, while, at the same time making large cost savings.

Good legibility. A message has good legibility if it is easy to read, and if the reader can easily see and distinguish all different parts of the message. Good legibility is probably always economically advantageous, whereas poor legibility may be a costly business for all parts involved. See *Legibility, Legibility of pictures, Legibility of text*.

Good picture. See *Good visual*.

Good picture quality can be defined as the degree of coincidence between the sender's and receiver's subjective perception of the picture and the reality (external or internal) represented

by the picture. According to this definition, the concept “picture quality” is related to the entire communications process.

Good readability. A message has good readability when it is easy to understand. Good readability is probably always economically advantageous, whereas poor readability may be a costly business for all parts involved. See *Readability, Readability of pictures, Readability of print media, Readability of text*.

Good visual. A “good” visual has a high level of picture quality. It is well worth reading and is executed so as to be legible and readable and be displayed in an optimum context in an appropriate format. The visual should convey information without ambiguity. It should be stylish and attractive, and is often, but not necessarily, also aesthetically pleasing. A schematic drawing has good legibility if it is easy to read, from the viewpoint that the reader should easily be able to see and distinguish all the different parts of the schematic picture.

Grapheme is the smallest semantically distinguishing unit in a written language. A grapheme is analogous to the phoneme in a spoken language. It may or it may not carry any meaning by itself, and it may or it may not correspond to a single phoneme. See *Visual phonemes*.

Graphic design. A generally accepted view is that graphic design may be described as the art and craft of bringing a functional, aesthetic, and organized structure to different kinds of texts and illustrations. Graphic design is a *process* (verb) as well as a *result* (noun) of that process. See *Graphic design genus, Graphic design objectives, Graphic design processes*.

Graphic design genus. Although we may not think about it, the practice of graphic design is as old as recorded history, and we see the results of graphic design every day. We see books, magazines, packages, papers, posters, symbols, and many other products. A generally accepted view is that graphic design may be described as the art and craft of bringing a functional, aesthetic, and organized structure to groups of diverse elements. Graphic design is a *process* (verb) as well as a *result* (noun) of that process. The purpose of work with graphic design is to find a suitable presentation for the content with respect to the receiver, the subject matter, the medium, and the financial situation. The interpreter/s may develop new views, relaxation, emotions, awareness, attention, understanding, and awareness. Graphic design includes typography, layout, visual graphic design, and parts of architecture and industrial design.

Within a given area, such as a page in a book, a poster, a label, a computer screen, or a projected image the designer may alter the design of headings, margins, ornaments, pictures, space, symbols, and text. Deliberate typographic variation is used to present the content in the text in a clear way. Often graphic design is thought of with regard only to the print medium, like books, exhibitions, magazines, newsletters, packages, papers, posters, signs, and many other products. But it is also used in several other media. Good graphic design is simple, bold, and direct. It ensures that significant design elements will be noticed by removing insignificant elements wherever possible. An “elegant design” must be reduced to its essential elements and each element reduced to its essential form. Graphic design is used as an important “tool” in the other four parts of message design. The most fundamental design technique is re-

duction. However: “The taint of commerce has relegated graphic design to the status of a ‘second class’ discipline in the academic realm.”

Graphic design objectives. In graphic design the main objective is to provide functional, aesthetic, and organised structure to all kinds of information sets. The individual information interpreters might be seen as “readers.” They may develop new views, relaxation, emotions, awareness, attention, and understanding. In the writing of *graphic design objectives* it may be an advantage to use verbs like *find*, *identify*, *read*, and *recognise*. These verbs all denote observable behaviour. An example of performance objectives for a table may be: “100% of the users should be able to find the time for departure of the train to XY.”

Graphic design processes. Many authors have suggested various design processes. The following steps may be used in a graphic design process: 1) analysis and synopsis, 2) production of draft, 3) production of script, and 4) production of original and master. Each step includes a review activity.

Graphic designers of today have even more freedom than the monks during the Middle Ages. Now, it is possible to combine words and pictures at will, in effective and efficient layouts, adopted for all media. Graphic designers work in “persuasion design,” as well as in “instruction design,” and in “information design.” Graphic design is a natural part of these design areas. Graphic designers are responsible for typography and layout in information and learning sets. The graphic designers may also produce the final master for printing.

Graphic elements. See *Basic elements, Dots in visual language*.

Graphic markers. Arrows, boldface type, headings, and white space are all examples of external textual structure. Arrows can be used for cueing when information is located in places other than in the normal directional flow.

Graphic media. See *Graphical media*.

Graphic messages. Any graphic message should be legible, readable, and well worth reading for the intended audience. Photo manipulation and stylistic embellishment can be used to create dishonest figures and tables. Both designers and readers must be mindful of possibilities for honesty and dishonesty in graphic messages.

Graphic symbols may be intended to convey generalities of the same order of abstractness as verbal terms. In some cases we can see graphic symbols as visual terms. Graphic symbols may be used to create an overview, identify information, illustrate position, illustrate size relationships, navigate in databases, provide a holistic perspective, recognize information, and represent an organization, a service, or a product. Graphic symbols may supply information and supply instructions. Graphic symbols often make use of bright colours to intensify their meaning—in fact in some instances a change of colour creates a diametric change of meaning. Common hues in graphic symbols are pure yellow, red, blue, green, white and black, or combinations of the same. Graphic symbols are interpreted in many different ways. Sometimes only a few persons will understand the intended meaning of a symbol. Thus, the sender will always

have to supply explanations for the symbols used in any specific situation. See *Symbols*.

Graphic user interface, GUI, is a communication system. GUIs differ from fixed interfaces by tailoring information to different situations and only displaying information important for the moment. Graphic interfaces can supply instructions on when, where and how the user should enter data in different computer systems and certain equipment. See *Fixed interfaces*, *Interface*.

Graphicacy is the ability to generate and interpret information in graphic information such as charts, diagrams, graphs, maps, plans, photographs and symbols. Graphics are far more readily available and widely used than ever before. There are no universal conventions for graphics.

Graphical literacy is the ability to generate and interpret information in graphic information such as charts, maps, graphic, and other pictorial presentations. Graphics are far more readily available and widely used than ever before. There are no universal conventions for graphics.

Graphical media, or *Graphic media*, are made using manual or technical methods. Graphical prints, paintings, signs and drawings are examples of manually produced images. Letters, manuscripts and signs are examples of manually produced text. Evening newspapers, morning newspapers, the popular press and comic books are examples of periodic publications. Children's books, non-fiction, cookbooks, course literature, textbooks, periodic books, reference books, comic books and fiction are examples of books. Different types of packaging belong to

the category ‘graphical media’, as they often have printed pictures and text. The main task of packaging is obviously to enclose and protect the contents. Text and pictures often describe both what packaging contains and how the contents are used.

Graphically complex texts. Readers often react in a positive way. Texts with good typography will be noticed. It is more likely that graphically complex texts will be read than “plain” texts. It also takes less time to read a graphically complex text than a “plain” text.

Graphically literate. A graphically literate person is comfortable with symbols and graphical expressions.

Graphics editors work on schematic pictures that are delivered by subject matter experts and writers. They produce finished schematic pictures. The work encompasses editing of pictures to creating completely new pictures, to convey the intentions of the subject matter experts. There may also be a need for illustrators, fine art artists and photographers, video producers, film-makers, and several others to produce the visual images that are needed.

Graphics. The word “graphics” can be used for completely different concepts, here often the same as “information graphics” a purposeful integration of text, pictures, and graphic design into a clearly delineated and structured area, i.e., a functioning whole.

Graphs are numerical arrays in pictorial form. They consist of curves, line graphs, polygons, scales, and a variety of special-purpose graphs.

Gravure was first developed in 1875. The printing surface is divided, by means of a screen, into a series of cells etched below the plate surface. The surface may be treated in various ways to produce cells of varying size and depth. Sheet-fed and web-fed presses may be used in gravure. Gravure printing gives good picture quality, but text is fluffy and ragged. Web-fed presses have the plate wrapped around a cylinder and they can operate at high speeds. They are called cylindrical, or rotary, presses. Such a printing process is called *rotogravure* and is extensively used for printing of weekly publications, catalogues, and brochures in large runs.

Green and red. See *Anomalies of colour vision*.

Greenough. Around 1850 the American sculptor *Horatio Greenough* (1805–1852) wrote, “form follows function.” The American architect *Louis Sullivan* (1856–1924) made this phrase famous in 1896.

Gregory the Great (540–604) was the Pope who stated: “What writing is to the reader, pictures are to those who cannot read.”

Grid, a geometric pattern used as a base for layout.

Griffo. See *Manutius*.

Gropius. See *Bauhaus*.

Grouping principle is also known as the *law of grouping*. Most figures are defined by a boundary. However, the presence of a boundary is not required for the perception of form or shape. When small elements are arranged in groups, we tend to

perceive them as larger forms. Small dots can form a triangle, a circle, a square, a rectangle etcetera This is similar to “closure.” The principles of common region, connectedness, proximity, similarity, symmetry all work together to evoke grouping.

Groups of information materials. With the main objectives as the starting point, seven distinct groups of information materials are discernible. Differences between information materials are considerable within each group. There are usually clear and distinct differences between the seven groups. The seven groups are: 1) Advertising and propaganda. 2) Informative entertainment. 3) Brief messages. 4) Administrative documentation. 5) Factual information. 6) Instructions. 7) Teaching aids. However, some information materials simultaneously contain more than one kind of information message. Packaging may contain e.g. both factual information and one or more instructions. Packaging etc. could well be assigned to a category with ‘combined objectives.’

GUI. See *Graphical user interfaces*.

Guidance is a term for a group of information materials in the category *Instructions*. Guidance provides assistance and uses detailed written instructions to explain how to behave in a general, professional and appropriate manner e.g. in solving a problem or performing certain tasks. A handbook provides broad, summarised information on subjects, often practical in nature. It may deal with e.g. the art of angling, riding, painting, growing flowers, collecting stamps, bird watching in the field, drawing etc. Guidance in brochures and handbooks may be

more than superficial. You often need to return repeatedly to guidance.

Guidelines are normative and aim to streamline design processes according to a set routine. Guidelines may be issued by and used by any organization to make actions more predictable, and of higher quality. However, by definition, following a guideline is never mandatory. See *Message design principles, Principles*.

Gutenberg. Johann Gutenberg (1399–1468) developed a revolutionary technology for printing books with movable type. He published the *Gutenberg Bible* in Germany (1452–1454) with illuminated decorations. See *Gutenberg Bible, Technology for words*.

Gutenberg Bible. The 42-line Gutenberg Bible is printed in the black-letter type styles that become known as *Textualis* and *Schwabacher*. Here straight vertical strokes are combined with horizontal lines. The complete Gutenberg Bible has a total of 1,272 pages. Most copies were divided and bound in two volumes. Heavier copies on vellum were sometimes bound in three or four volumes. The Gutenberg Bible had a huge effect on the history of the printed book. The development of the new printing technology resulted in a dynamic and easier dissemination of the printed word.

Gutter is the margin at the binding edge of a page, or inside edge of unbound pages. Thick books need to have wide inner margins.

H

H-height, *cap height*, or *height*, is the size of capital letters in a typeface, expressed as a percentage of the point size. See *x-height*.

Hairline. A hairline is the finest line in metal type. Hairlines are often used to divide columns.

Halftone. A halftone is a reproduction in which tones have been photographed through a screen. The picture is divided into dots. Size of dots governs darks and lights.

Halftone picture. To be able to reproduce the fine nuances of a photograph or fine art the original must be divided into small picture elements. A reproduction camera is used for photographic separation (analogue technology). Here raster-screens are used to transfer the original image into a raster-image. It is also possible to use a scanner (digital technology) to create the raster-image. A picture needs a large number of pixels. In fact when the resolution is only 100 lines per inch one A4-page has more than 5.8 million pixels.

Halftone screens make it possible to print photographs. The first colour photographs were reproduced in 1881. Advances in photoengraving and halftone techniques allowed the regular use of photographs in print media by World War I. Because of the development of the modern computer the methods for presenting photographs are now changing radically. Halftone screens can be simulated with computer programs that sidestep the entire photoengraving process.

Hand-held scanner. A hand-held scanner is moved slowly over an image on paper at an even pace. The hand-scanner reads a ten centimetre wide strip at a time. The resolution is usually 400 dots per inch and 16 gray levels. A graphic input tablet allows you to digitize an image by tracing the lines on a drawing with a hand held device like a mouse.

Handcrafted visuals such as a diorama, drawing, painting, and sculpture takes a long time to make, is highly personal, exists only in individual, unique copies, and only reaches a narrow public. Pictures made by children often display considerable spontaneity and reveal a great deal about their development, maturity, and personality. In all handcrafted pictures the relationship of information presented to reality is totally controlled by the artist. Most photographic pictures, though, are often records of an event or object that actually existed. See *Picture circle*.

Hanging indents, or *Outdentation*, is the reverse of indentation. It is often used in lists with bullets, and in lists with numbers. It may also be used in bibliographies and reference lists, for the lines following the initial line in a reference. See *Indents*.

Harmonious page. See *Golden ratio*.

Harmony in design can be said to be a pleasing arrangement and combination of elements to form a consistent and orderly whole. Harmony is one of the *aesthetic principles* in information design. Certain design elements look good when they are placed together and when they interact in a final design. Other design elements may look ugly and be distracting. There is harmony in information material when all design elements fit

well together and form harmonious and pleasing relationships. Harmony is often closely related to *unity*. Man has an intuitive sense of balance. Information material should display good balance, in a manner, which is interesting but not disturbing or distracting. See *Balance*.

Harmony in typography will be achieved when there is good relationship between the individual elements in the design and the “wholeness.” A balanced typography gives an impression of quality and credibility.

HCI. See *Human computer interaction*.

HDTV. See *High definition television*.

Head position is a variable that will influence our perception of individuals in photographs.. Individuals looking straight at a camera look more in control than those individuals looking up or to the side. Individuals look least in control if they are looking down.

Head Up Display, HUD, is a special type of helmet used in advanced flight simulators and in Virtual Reality systems. Computer generated images are projected by fibre optics onto the curved visor in front of the pilot’s face. In the simulator the pilot gets a flying experience that is suggested to be true to life. In simpler simulator systems computer-graphics are projected onto several screens, replacing the windows, or located just outside the cockpit of the boat, car, or aircraft.

Headers, or *running heads,* may appear at the top of every page. They should provide information that will help the reader navigate in a document. In some books every left-hand page

have the title of the book, and every right-hand page have the name of the chapter. Headers may also carry page numbers. See *Footers*.

Heading, or *headline*, attract the attention of the readers, enhance and show the hierarchic structure, make the subject matter readily apparent, and indicate the relative importance of items. Well-written headings help the readers to find the information they want. Headings show the readers how you have structured your text.

Heading hierarchy. Headings on different hierarchic levels will provide the readers with reference points and help them organize information cognitively for better comprehension, retention and recall.

Heading placement. Headings shall be placed above and close to the following text. This distance shall be smaller than the distance to the previous paragraph.

Heading size. According to the “Rule of X’s,” the height of the uppercase X of a smaller typeface should be the same as the height of the lower-case x of a larger typeface in a hierarchy. Numbering and lettering systems can be combined with typographic cueing of headings. Headings set in different type versions aid comprehension of the material. In order to increase the contrast it is a good idea to use larger as well as bolder type when headings are printed in colour.

Heading style. Never end a heading with a full stop. However, a question is followed by a question mark (?), and an exclamation is followed by an exclamation mark (!).

Heading typography. We can use a special typeface for headings, for example a sans serif typeface like Helvetica or Verdana.

Headlines. See *Headings*.

Headword, or *entry term*, is the first word in the explanation of a term in a glossary. See *Glossary*.

Health literacy is an individual's ability to obtain, read, understand and use healthcare information to make decisions and follow instructions for treatment.

Hearing. Sound waves are transmitted from the eardrum via the small middle ear bones (hammer, anvil, and stirrup) to the inner ear. The movements of the third bone against the membrane in the oval window create changes in pressure in a fluid within the cochlea, the inner ear. This fluid causes a basilar membrane to flex back and forth. The auditory cells are located on this membrane. These cells cause the neurones of the auditory nerve to send signals to the brain for processing. Different frequency sounds are perceived when different parts of the basilar membrane vibrate in response to these frequencies.

Height of character. See *Size of type*.

Height, *cap height*, or *H-height*, is the size of capital letters in a typeface, expressed as a percentage of the point size. See *x-height*.

Helvetica was developed from the Bauhaus tradition, inspired by the font Futura. It is the ultimate design of the Bauhaus–Swiss–International schools. Nowadays we see texts in Helvetica everywhere around the world, on billboards and posters,

in books, magazines and newspapers, as well as in numerous publications of various kinds. Helvetica typefaces are very useful for captions, headings, single words in pictures, tables, and for titles of various kinds. Helvetica is often used in business graphics, for over-head transparencies, and reader slides. But Helvetica may be hard to read in running text. In running text, it is difficult to tell the difference between uppercase I and lowercase l (and also the number 1). This becomes particularly troublesome in words such as “Illustration.” Thus Helvetica is an inappropriate font in a language like French where this combination of letters is common. See *Miedinger*.

Hi-Vision The television-image is built up by 1,125 lines in Hi-Vision, by 525 lines in the NTSC system, and 625 in PAL. Each line in Hi-Vision has 1,000 pixels. To manage the high definition television-image’s closer line construction, the bandwidth for each channel on the transmission side has to be increased to about 30 MHz. For conventional television a bandwidth of 6 MHz is sufficient. A capacity of 30 MB per second is needed to handle moving high definition television-images in a computer system. See *High definition television*.

High credibility. A high credibility message has a good structure, convincing arguments, proper references, and relevant examples. High credibility sources exert a more persuasive influence on the receivers than low credibility sources. Receivers believe in a message of high credibility.

High definition television. The traditional PAL, NTSC, and SECAM television systems are all analogue. Analogue waves cannot be compressed to carry more data. In order to increase

the quality of the image it is necessary to use digital data. These formats are called high definition television, HDTV. The aspect ratio of high definition television is 16:9. This ratio is similar to some current wide screen movies. There are a number of different formats for high definition television. See *Hi-Vision*.

High-low bar is a schematic picture. See *Bar charts*.

High-low close bar is a schematic picture. See *Bar charts*

Higher level learning. See *Double-loop learning*.

Hippocampus in the brain is an important structure in memory and spatial behaviour.

Hiragana. See *Japanese*.

Histogram is a schematic picture. See *Graphs*.

Horizon. Don't centre a horizon. Place the horizon in the upper or lower third of the picture.

Horizontal bar chart is a schematic picture. See *Bar charts*.

Horizontal lines are restful and relaxing and they create a strong sense of equilibrium in any composition. Horizontal lines that are parallel to the borders of the picture give the impression of calm and stability. A horizontal line can serve, e.g., as a horizon, a street, or a sea. Horizontal lines are perceived as being shorter than equally long vertical lines. See *Lines in visual language*.

Hot lead typesetting. See *Hot type*.

Hot metal typesetting. See *Hot type*.

Hot type, *hot lead typesetting*, *hot metal typesetting*, *mechanical typesetting*, *metal type*, refers to 19th-century technologies for typesetting text. Hot melted type metal is injected into moulds. The resulted characters are used for printing ink onto paper.

HUD. See *Head Up Display*.

Hue is the basic component of colour corresponding to different wavelengths. Most people are familiar with hue through our labelling of colours such as red, orange, yellow, green, blue, and violet. In colour description systems hues are usually placed in a band around a centre, in a colour-circle. All of the colours in the rainbow are hues in the visible spectrum of light.

Hue Lightness Saturation System (HLS) is a colour description system. The hues are arranged as circles on the outside of a double cone resembling the NCS Colour Solid. Hue specifications start with blue at 0° and then follow the spectral order around the circle. Lightness and saturation are defined as percentages from 0 to 100. The HLS system is easy to use for colours on the surface of the model. However, colours inside the model are difficult to define. As in the Munsell- and NCS- systems, brightness creates problems.

Hue Value Saturation System (HVS) is a colour description system that is rather similar to the NCS-system but utilizes another coding. Value is defined as the relative lightness. White has full value and black has no value at all.

Human communication. A general principle of human communication is that the likelihood of successful communica-

tion increases when a concrete reference is present. In the absence of the actual thing, the next best reference is a visual representation of the thing. Often a visual is a more pertinent reference for meaning than the spoken or written word. Visuals are iconic and they normally resemble the thing they represent.

Human computer interaction (HCI) comprises research on the design of computer systems that support people so they can carry out their activities and tasks productively and safely. HCI has a role in the design and development of all kinds of man-machine systems. Safety aspects are very important in the design of control systems for air traffic and nuclear plants. High productivity and job satisfaction are important issues in office systems.

Human vision. See *Vision*.

Humour is often used in cartoons to point out a special situation, an occurrence, or an event. Humour and visual puns may attract attention to the content. However, humour should be used with great care. Misuse of humour and “funny people” may ruin the intended message. This is sometimes referred to as the “vampire effect.”

Hybrid image 1. Hybrid images are created in a computer combining bit-map layers with object oriented layers.

Hybrid image 2. Depending on the viewing distance a hybrid image is perceived in different ways. Hybrid images combine the low-spatial frequencies of one picture with the high spatial frequencies of another picture.

Hybrid systems. In contrast to film and television, video-systems makes it possible to freely scan forward and backwards, study pictures frame by frame, repeat interesting segments of a videotape or videodisc, or pass uninteresting parts. Here navigation is rather unregulated, totally linear, and based on visual browsing of images.

Hypermedia, or “multimedia hypertext,” may include text, graphics, sound and video. The links are usually indicated with “anchors,” special areas in a text or on a display. Clicking the mouse on an anchor causes the link to be followed to the anchor at the other end. After a while it is quite easy to get totally lost among the information, and among the documents stored in a hypertext structure. Many readers may find the hypertext and hypermedia disorienting and difficult to navigate through.

Hypermetropia. See *Myopia*.

Hyperrealism is a genre of painting and sculpture resembling a high-resolution photograph.

Hypertext is text, not constrained to be linear, containing links to other texts within a document or between documents. Quite often hypertext documents and hypertext structures also include pictures.

Hypertext literacy is a literacy made up of new and technologically altered kinds of access. Anyone can publish a website.

Hypertext systems. The interest in hypertext systems other than the WWW has decreased during the last years. Around the world software designers are trying to create systems that combine the unique capabilities of computers and the human capa-

bilities of understanding complex information structures. It seems to be a good idea to use a structure that is already familiar to the readers. The structure of a library, the departments, the bookcases, the bookshelves, the books on the shelves, the chapters in the books, and the sections in the chapters may be recommended in many cases. For large hypertext or hypermedia structures one or more indexes may be the best way to access information.

Hyphen (-) clarify your meaning when using two or more words to form a compound adjective. Using hyphens is a way of making expressions with three or more nouns in a row more precise. Use hyphens after certain prefixes: not normally after Latin and Greek prefixes, but often after English. See *Dash*.

Hyphenation. Lines can be broken according to different principles. According to one principle, lines can be broken only between words. According to another principle, lines can be broken also within words. This can be done phonetically or according to etymology. In mechanical word breaks, lines are broken at the most convenient point, regardless of meaning. It is known that poor readers have difficulty reading hyphenated text.

I

IA. See *Information architecture*, and *Information assurance*.

IBT, *Internet-based training*, is a kind of E-learning. See *E-learning*.

Iconclass. The *Inconclass system* was developed in Holland. It has a systematic catalogue on theological subjects. The system is often used for classifying artistic pictures. Each picture can be assigned a classification comprising a few index words/codes. The method is based on a description of the picture's main subject. Picture details and minor subjects cannot be indexed. See *Outline*.

Iconic memory (vision) is closely related to the sensory memory. This memory precedes the integration of signals from various sensory systems. See *Sensory memory*.

Iconologia. See Ripa.

ID. See *Information design*

ID SIG is a group for information design in the Society for technical communication (STC).

Idealistic right. See *Copyright*.

Ideogram is a graphic symbol that represents an idea or a concept.

Idiom. An idiom is a fixed expression whose meaning is not discernible from the definitions of the individual words of which the expression is made up.

IIID, *International Institute for Information Design*, sponsored by the Austrian Federal Ministry of Transport, Innovation and Technology, was organized to “...develop research and practice in optimizing information and information systems for knowledge transfer in everyday life, business, education and science.” IIID defines information design as “...the defining, planning, and shaping of the contents of a message and the environments it is presented in with the intention of achieving particular objectives in relation to the needs of users.”

Illusion. One stimulus can be perceived in different ways on different occasions. There are many examples of “transformation pictures” and of “impossible pictures.” When the brain analyzes new data, it automatically adds or subtracts information in an effort to obtain a “sensible” interpretation of that data. Horizontal lines are often perceived as being shorter than equally long vertical lines. Open and light forms are perceived as being larger than closed and darker forms of the same shape in the same size.

Illustrated manuscripts. The Egyptians were the first culture to produce illustrated manuscripts and wall decorations that combined their writing system with illustrations. See *Books of the dead*.

IM. See Information management.

Image association. Realistic photographs can generate a great variety of associations in audiences. Visual experience is subject to individual interpretation. Different assignments to a picture will influence the meaning in the mind of the viewer.

Image content. Variables related to *image content* are the degree of realism, the amount of detail, objects, time, place, space, events such as “action”, humour, drama, violence, etc., time displacement, parallel action, metaphoric descriptions (symbolic actions), the relevance and credibility of the contents, comparisons and statistics, motion, sounds such as speech, music, sound effects, and emotions. Some of these variables apply to moving pictures in films or TV. Some apply to stills in printed media like books, newspapers, etc. Others apply to both stills and moving pictures. The contents of pictures can evoke highly positive or negative responses in viewers, especially in children. Visual language can affect our attitudes and emotions more easily than speech and text.

Image context. A picture has both an internal and an external *context*. I regard factors inside the medium as internal context or inner context. In books internal context is the interplay between text and illustrations, the interplay between illustrations and layout. Movies and TV programs have sound with speech, music, and sound effects plus visual and audio metaphors. Some computer programs contain advanced animation with interaction between text, images, and even sound. I regard the entire communications situation, i.e., senders and their intentions for the picture and receivers and their circumstances (e.g., time available), as external context.

Image databases may be defined as “a logically coherent collection of digitally stored images with some inherent meaning.” A computer-based *image retrieval system* is needed for searching and retrieving the digitally stored images. Image databases have many implications for society and are used in a wide vari-

ety of applications such as: anatomy, astronomy, automated catalogues in museums, biology, botany, computer aided design, criminal identification systems, cultural heritage, geographical information systems, geology, house furnishing design, industrial systems, manufacturing systems, medical image management systems, mineralogy, and multimedia libraries.

Image design is the development and execution of visual messages. It is a powerful form of communication because visual messages stimulate both intellectual and emotional responses—they make us think as well as feel. Generally speaking it is not possible to rank the different types of visuals. Often the type of visual that should be used must be determined in each case with a view to demands on the picture and the prevailing budget framework.

Image element. See *Dots in visual language*.

Image execution. Variables related to an image's *graphic execution*, form, or art style might consist of image factors and image components. They are composed of non-significant image elements, such as dots, lines, and areas in different combinations. Examples of image factors and image components are image type, i.e., whether images are drawings, paintings, photos, computer-generated visuals, etc., brightness, light, shape (external shape, external contour), size (image, subject, depth), colour (hue, value, saturation), contrast, emphasis, composition (organization, centres of interest, balance), perspective (depth, depth-of-field, image angle, image height), technical quality, symbols, signs and code signals in the image,

pace, speed change (slow, fast), editing, zooms in and out, panning, visual complexity, and visual effects.

Image format. The choice of *format* is of major importance to our perception of image contents. Our perception of a picture (such as a photograph) changes when we view it as a paper print, transparency projected on a white screen, as a computer image, etc. If you watch a film on TV, cable TV, or VCR at home alone, your perception of the film is very different from your response when you watch the same film on a wide screen with hi-fi sound in a cinema full of people. In analogical technical systems, letters and numerals are represented by defined “type” (a, b, c, ...). Pictures consist of lines and halftone dots. In digital systems, image elements are mathematically defined either as intersections of coordinates and vectors providing direction or as “pixels”, i.e., small rectangular image components.

Image framing. A frame or a box around an image, or sometimes around an illustration and text, may have different functions. Image framing can be functional and/or attentional. A frame will separate the image from the surrounding context and draw special attention to information within the frame. In a newspaper, framing is a way of helping the readers to combine the corresponding text and pictures on the page.

Image functions—communication. According to researchers in the areas of instructional message design, visual literacy, and visual communication the most common opinions on functions of visuals concern *attention*. Researchers mention *attract, gain, get, hold and maintain attention*. Other common explanatory verbs are: *facilitate, provide, persuade, create* (an inter-

est in), *illustrate, clarify, motivate, present, and reinforce* information (to someone).

Image functions–information design. In information design the most common purposes of pictures are to: *visualize, clarify, inform, attract attention, facilitate reading, explain, and convey information*. The type of visual to be used in the production of materials for information and learning must often be determined in each case with a view to specific demands on the visual, and also to the prevailing budget framework.

Image functions–learning. The most common purposes of pictures in the school environment are to: *show, explain, visualize, illustrate, clarify, inform, summarize, convey, mediate, elucidate, present, and give* (perceptions), *instruct, describe, and entertain*. There seem to be different “fashions” in teaching practice that differ from culture to culture and can change over time within different cultures. Fashion in the use of educational media is partly related to the technology that is available in that specific culture at that time.

Image manipulation implies the improper control of people's perception of a given reality through the use of pictures. The ethical rules for the press, radio and television clearly warn against manipulation or falsification of picture content through misleading captions, odd montage, or suspicious trimming. Photo manipulation and stylistic embellishment can be used to create dishonest figures and tables. Presenting inauthentic pictures as though they were real documentary material is forbidden. The party purchasing the right to use pictures is responsible for their proper use. Despite these rules, clear violations

occur all too often. In production of news the editors should ask themselves if every photo meets the ethical standards of responsible journalism.

Image manipulation—additions. The relation between width and height of the image can be changed by the addition of space. To achieve emphasis it is common to add information such as shadows, contrasts, colours, signs, and symbols.

Image manipulation—changes and deletions. To focus the reader's attention on the main content in a picture, individual picture elements can be changed so as to improve contrast, acuity, sharpness, grey scale, or colour scale. Surrounding parts can be made paler, darker, or out of focus. The visual's external contour can be blurred and unclear so the picture fades in/out of the background. Individual picture elements, as well as groups of picture elements, can be moved or turned around within an image for the sake of better balance and harmony.

Image manipulation—changing projection. The projection plane can be altered through image modification or shrinkage. This distorts size relationships within the picture and affects our perception of image contents.

Image manipulation—converting photos. It is far too common that artists transform photographs to artwork for use as illustrations in newspapers and books. To transform a photo into a drawing is not only unethical, it is also often an infringement of copyright.

Image manipulation—digital deception. Sometimes digital deception, or *digital photo manipulation*, may enhance a mes-

sage. Sometimes a photographer may use image manipulation methods in order to edit her or his own pictures.

Image manipulation—compression and expansion. An image can be compressed, i.e., squashed from the sides or from the top and bottom. It can also be vertically and/or horizontally expanded or stretched. This will of course change the size relationships within the image.

Image manipulation—regulations. Modern computer-based graphical systems have a lot of built-in possibilities for manipulating images. Usually we need permission from the copyright owner, and—from an ethical point of view—also from any person in the picture. Artistic works are protected for the originator's entire life plus an additional 70 years. Thus, many works are protected for more than 120-130 years. It seems that photo manipulation has become a common practice for many graphic designers working in advertising and entertainment. However, in news, information design, and instruction design, readers and viewers expect pictures and images to represent the truth in a correct way.

Image morphology. An artist producing a picture on a canvas or on a paper may use crayons, lead, India ink, paint, and other materials. Combinations of dots, lines, and areas gradually produce the image. The actual picture is built up from materials and pigments, which, according to intentions, can be completely separated or gradually mixed. In technical systems the whole motif may be captured at once with a traditional camera, or it may be scanned line by line with a TV-camera. Except for the printing of line drawings, all other physical pictures have to be

divided into small elements, picture elements, or pixels, in the technical process of duplication, e.g., in the printing of books or in the broadcasting of television. The image has vertical (y) and horizontal (x) resolution and it has also “depth resolution” (z). An individual pixel may vary with respect to shape, size, position, value, grain, colour, and grey scale. See *Virtual images*.

Image pairs. In many situations it is a good idea to use pairs of visuals in which one is true-to-life, such as a photograph, and the other represents an analytical representation, such as a simple line drawing. The analytical visual makes it easier for us to understand the content, and the realistic visual enables us to believe in the content. So the two visuals should be closely linked in a carefully thought-out relationship.

Image placement. A picture may be placed on a page in many different ways. It is usually adjusted to the width of the text column. A page with more than one column has more possibilities for placement of pictures. As a rule, pictures may be placed where they best serve the presentation. Very small pictures can be placed in a narrow column. On the other hand, wide pictures may cover the entire text area of the page. Too many pictures will confuse the layout and reduce the chances of the reader getting involved in the text. Too few pictures appear to increase the size of the body text. A picture may expand beyond the width of the column and cover the margins and sometimes the whole page. “Bleed” (covering the entire page, with no margins) may be used constructively and creatively to expand the impact of important attention-getting images.

Image recognition. Image recognition technology has made it possible for robots to identify objects and to detect errors, such as misplaced parts. Robots have regulated search and operate in linear patterns.

Image retrieval systems. Retrieval systems for first-generation image databases included alphanumeric strings, full scripts, and keywords. See *Indexing systems*.

Image sequences. Sometimes it is necessary to divide a message content into a series of pictures. Time scales and charts provide a reference in time and space. A sequence of pictures can be used to explain a development over time, hold a chapter together, or enhance the depth dimension in a printed material.

Image stones. An image stone, *picture stone* or *figure stone*, is a raised ornate slab of stone, usually limestone. All image stones have carved and painted visual stories. However, a few image stones also have runic inscriptions. More than 400 image stones are known. Motifs often tell stories from the Nordic mythology. There are image stones from AD 400 until the 12th century.

Imaginary perspectives were used in architecture and pictorial art for the purpose of creating illusionistic effects during the Baroque era. See *Psychological perspectives*.

IMAX is a wide-film system giving a large picture area. The film-frames are put “lengthwise” on a 70-mm film and not “crosswise” as on normal 35-mm film. IMAX is projected onto a large flat screen. The audience sits high up in a slanting auditorium, with a shorter distance to the screen.

Imbalance creates an uncomfortable feeling in the reader and should often be avoided. However, imbalance can be used to dramatize a design and attract attention within a picture or within an information material. Irregular, unexpected, and unstable design will attract attention. . Several artists use a visual strategy, such as combinations of dark and bright, large and small, round and square, to sharpen meaning. As soon as instability is introduced in a design the result is a provocative visual expression. The eye will struggle in order to analyze the relationships and the balance within the picture. See *Informal balance*.

Imperfection in type has been regarded as friendly.

Immediate memory. See *Sensory memory*.

Implicit memory. See *Procedural memory*.

Improve application. It is important to use new knowledge. We will remember relevant and meaningful information if we have use for it. The usefulness of conclusions made by other people is limited. We must gain confirmation through our own experiences. The information must be internalised.

Improve attention. The learning process starts with attention, such as curiosity, excitement, expectation, or fear. In pedagogy this is called *motivation*. Pay attention to important information, and think about why this information is important. Avoid mental overload. Minimise distractions and establish your priorities.

Improve learning techniques. Imagine that your brain-cells are organised like trees, storing related information on its

branches. Try arranging key points of any topic on a sheet of white paper in the same tree-like format. Start with the central topic in the centre of the page. Draw branches spreading out from it

Improve listening skills. We can improve our listening skills. We need to concentrate and be active rather than passive listeners. See *Listening skills*.

Improve long-term memory. Work mentally with new information. Review and reflect. Learn and store information in a meaningful and organised way. Relate new information to what you already know. Place realistic expectations on yourself. Reward yourself. Use learning techniques.

Improve perception. Human perception is only sensitive to changes in stimulation. You actually perceive less than all you see and hear, and much of the information is never used. At the same time, you perceive more than you see and hear. You believe that you see and hear things that are not there. Your brain fills in missing information. Accurate identification can be made from the correct perception of just a few parts. Break large tasks into smaller ones. Summarise information. Make sure that you understand the problem at hand. Read pictures and captions carefully.

Improve prerequisites for learning. For learning to occur you must be mentally prepared to learn. You must be interested and curious. You must be willing to learn. Get an enthusiastic mentor. Work together with other learners. Use relevant and meaningful material from different sources. Use all your senses.

Improve processing. Information is converted into experiences and insights that are converted into knowledge. We need to understand the function of both our short-term memory and our long-term memory. There are special learning techniques.

Improve reading skills. There is no doubt that we learn a great deal from reading. Be an active, and not a passive, reader. Increase your vocabulary. Learn the relevant terminology. Look for usable information. Preview the chapter at hand to get an idea of its topics and sections. Read the chapter outlines, the section headings, and the summary. Find answers to the questions what?, who?, when?, where?, how?, and why? while you read the text.

Improve short-term memory. Organise information into larger units. Rehearse information. Put essential information in long-term memory as soon as possible. Make notes.

IMS. See *Information management*.

Indentation. In order to emphasize the beginning of paragraphs in running text the first lines may be indented and start with empty spaces. See *Indent*.

Indent, (verb) to start a line of text away from the column margin, and (noun) the actual space away from the margin. See *First line indents, Full paragraph indents, Hanging indents, Nested indents,* and *Negative indents*.

Industrial robots. See *Visual structures*.

Inertia. The eye has inertia. This inertia enables us to perceive motion. When we look at a person who is walking or running,

the eye records a series of stills that ultimately blend into one another and form a moving image. This inertia also enables us to see motion in the stills that comprise a movie film or a TV image.

Index of frequency is the number of pages with any visuals in percent of all pages (except title pages and indexes).

Index of readability (LIX) is an index that shows how easy or hard it is to read a text. (See *Readability*.) LIX is calculated as follows: 1) Count the number of words in the text. 2) Count the number of words with more than six letters. 3) Count the number of sentences. 4) Divide the number of long words by the total number of words and multiply the product by 100. This yields the average word length (WL). 5) Divide the number of words by the number of sentences. This yields the average sentence length (SL). 6) $WL + SL = LIX$. (LIX 20–30 = simple text, suitable for children’s books; 30–35 = literature; 35–45 = moderately difficult text, weekly magazines; 45–50 = popular science subjects; 50–55 = difficult text, trade literature; 55+ = extremely difficult text.)

Index of utilization is the degree of use of media or pictures in teaching. When teachers never utilize a specific medium the index is 0. When teachers utilize a medium every lesson the index is 100; 50 means every week; 25 every month; 12.5 means once during the semester. Teachers usually use the blackboard and textbooks in their teaching. During everyday-lectures, use of other media is rare. Several media are never used at all, or are used only a few times during a whole semester.

Indexes are lists with page numbers to various parts of the content in a document. Like the reference list, the index might be bulky. To aid overview and easy access, an index is often arranged in two or three columns. The index text is set in smaller type on shorter lines than the running text. As with the reference list, an indented text may be used.

Indexing systems

A large number of indexing systems have been devised to guide access to individual images. However, real-life experience shows that it is often very hard to find the intended image. There are verbal and visual indices. A lot of research on retrieval systems is still needed.

Industrial design is the use of applied art and applied science in the design of industrial products. The design process may include concept generation, drafting, sketching, rendering, model making, production, packaging, and distribution of mass-produced goods. Many areas, such as aesthetics, art, business, economics, engineering, ergonomics, functionality, manufacturing, technology, usability, and techniques influence the design process. Industrial design can overlap with engineering design.

Infinite-point perspective. See *Four-point perspective*.

Infodidactics is an umbrella term for the methods used for teaching the various aspects of information design. The huge spread among the different disciplines makes information design an interesting, but also a complex area of research and teaching. The goal of all scientific enterprise is understanding. Work on the understanding of science has shown that some teaching leaves school children more confused than they were

without science lessons. This research is well documented and it is difficult for science teachers to accept these results.

When we understand a subject matter we are able to explain phenomena and predict new phenomena. Although information design theories frequently refer to descriptive theory and propositions, their main function is to guide the information designers in how to actually design, present and produce information sets. In order to do this, it is important to work with problem-oriented learning in realistic projects; with existing and true problems, with regular “senders” or “information providers,” with actual information materials, and with real “receivers” “information interpreters” that need the information. This also provides realistic experience with budget and time limits.

When working on group assignments students need to have continuous contact with each other. This can happen with personal meetings or by means of electronic mail, fax and electronic meetings in the different “virtual group rooms” or on an “electronic billboard” in a virtual classroom.

Infographer is another term for *information designer*.

Infography, the practical component of information design, is the actual, practical work with design and execution of structured combinations of words, pictures, and graphic design. Therefore a designer of messages needs to have good skills in writing comprehensible, clear and consistent texts, in creating clear illustrations, and in creating a clear, transparent typography and layout that will aid attention, perception, interpretation, understanding and learning for the intended receiver. The task of designing complete information materials may often be

far too overwhelming for one single individual. For that reason a team of people, with skills in different areas, are often working close together. See *Infology*.

Infology, the theoretical component of information design, is the science of verbal and visual presentation and interpretation of messages. On the basis of man's prerequisites, infology encompasses studies of the way a combined verbal and visual representation should be designed and produced in order to achieve optimum communication between a sender and a group of receivers. Infology models contain both theoretical (descriptive) elements as well as normative (prescriptive) elements. Producers of information and learning materials can facilitate communication, and the learning processes of the receivers. Complicated language, in both texts and pictures, will impair the understanding of the message. Active voice, attention, clarity, comprehensibility, consistency, emphasis, information ethics, legibility, memory, perception, precision, processing, quality, readability, reading value, simplicity, structure, and unity are all key concepts in information design. Any graphic message should be legible, readable, and well worth reading for the intended audience and any audio message should be audible, distinct, and well worth listening to. See *Infography*.

Inform. The verb *inform* means to supply or convey information or to provide knowledge of something and is therefore a unidirectional process, e.g., from one person to another. In my view, to *communicate* entails interplay between two or more persons.

Informal balance contributes to a feeling of dynamism. It may attract attention to a specific picture, to a part of a text or to the entire information material. However, imbalance and inconsistent use of colours, graphics, or typography, have been found to reduce learning. See *Formal balance, Imbalance*.

Informatic, or *documentalist*, is a person who collects and tabulates scientific information. This information is often sought in national as well as international databases.

Informatio. See *Information*.

Information. The term *information* is derived from the Latin noun *informatio*, which means a conception or an idea. It refers to 1) data, details, facts, and intelligence, 2) the import ascribed to specific data, 3) data processed in a computer, 4) an internal structure which regulates processes, 5) a formal written statement or accusation, 6) the action of informing against a person, 7) the giving of a form or essential character to something; inspiration, and 8) group of information materials in the category *Brief messages*. Information can be moved from one place to another and stored in analogue or in digital form.

From a terminological point of view the concept “information” may be placed somewhere between “data” and “knowledge.” It is not at all easy to draw any strict borderlines between these three concepts. We may view information from various perspectives with respect to how we create, present, produce, distribute, search, sort, index, store, receive, process, value, respond to, make use of, and renew information. Often several groups of people with different skills are needed for these activities. Each person has a set of individual experiences

and values that will influence their views of information. Information is merchandise, however quite different from other kinds of commodities. When transferred from source to recipient, or from seller to buyer, it remains available to both. Unlike the sale of a material product, like a camera, information transfer does not give the recipient the right of exclusive use.

Information access. Regardless of the selected medium and the system for distribution the intended receivers must have easy access to facts and information when they need it. There are two quite different aspects of the concept “information access.” One aspect concerns the *external access* to information materials stored in an office and information contents stored within an information system. The other aspect concerns the *internal access* to relevant facts and information contents within a specific information material. First we have to find the correct source and then we have to find the interesting content. Information stored in a computer system may be accessed in several different ways. The ease of use and the man-machine interaction are of vital importance. It is necessary to make the system as user friendly as possible by providing user support systems, standard function keys, and for example a possibility of full text search. Information and instructions should always be clear, consistent, concise, and simple. It seems to be very important that the user has full control of the system, i.e., with respect to reading rate and letter size when text is presented.

Information aesthetics deal with aesthetic aspects of information sets. Art is valued for its originality and its expressiveness. Here focus is on individual artefacts crafted through the manual and aesthetic virtuosity of the individual artist. Design,

in contrast, is valued for its usefulness for being appropriate for a particular user and a particular task. While a painter or a sculptor can choose any imaginable shape, a designer is limited by the function of the thing being designed. It is known that aesthetically pleasing visuals may not be of great instructional value. It is, however, possible that aesthetically pleasing information sets will be noticed and used better than a material without any aesthetic qualities. See *Aesthetic value, Aesthetics, and Philosophy of beauty*.

Information age. Throughout the 1980s, major changes occurred in the way our society produced, stored, processed, and accessed information. Modern information technology have an increasing impact on all aspects of our lives. We produce more information than ever before. Quite frequently, people find that their basic knowledge is inadequate. However, the tools of the information age have put vast volumes of information at our fingertips. In the future we will focus even more on the information content, the actual message, rather than on the traditional information materials as such.

Information architect. See *Information architecture*.

Information architecture, IA, involves the design of organization and navigation systems to help people find and manage information in complex information systems. IA includes databases, intranets, library systems, online communities, and websites etcetera. The information architect needs to think about the intended audience and the body of information that needs to go on the site, and think about how to break that down into chunks.

Information as merchandise. Information is merchandise, however quite different from other kinds of commodities. When transferred from seller to buyer it remains available to both. Unlike the sale of a material product, information transfer does not give the buyer the right of exclusive use.

Information assurance, IA, deals with the “trust” aspects of information. It is not possible to assure with a lack of trust. IA applies to all aspects of safeguarding or protecting information or data, in whatever form, and is not confined to computer systems, or to information in an electronic or machine-readable form. IA is closely related to *information security*. See *Chief Information Officer*.

Information box. Information materials can be structured in a three-dimensional model, i.e. an *information box*, for each subject field. This box describes the relationship between objectives (x), media (y) and target groups (z). A number of such boxes can be devised. Each box covers hundreds of conceivable types of information materials, all with a specific subject content.

Information carrier is the material that carries the information, such as electromagnetic waves, film, magnetic tape, paper, and plastic.

Information competence. . An information literate person has *information competence*, and accesses, evaluates and uses information in a qualified way. See *Information literate person*.

Information cone. The amount of available information is growing every day. Research and development produce more

information content than ever before. This growth can be described with a cone, the information cone, growing over time. In a new area it is easy to have an overall view of all available information. When the amount of information grows the need for new ways of navigating and browsing increases.

Information concepts include copyright, information access, information assurance, information competence, information disciplines, information ethics, information layout, information quality, and information structure.

Information content. In the future we will focus more on the information content, the actual message, rather than on the traditional information materials as such. We need access to the information required for maintenance of a machine, not necessarily for a printed document with this information. Many traditional printed documents will be replaced by on-line services. This is a paradigm shift.

Information costs. Good legibility and good readability are probably always economically advantageous, whereas poor legibility and poor readability may be a costly business for all parts involved. If readers do not understand the text, or if they interpret it incorrectly, it becomes very expensive. See *Cost of reading, Costs*.

Information design, ID, comprises analysis, planning, presentation and understanding of a message—its content, language and form. Regardless of the selected medium, well designed information set, with its message, will satisfy aesthetic, economic, ergonomic, as well as receiver and subject matter requirements. See *Design, Information design areas, Information design as-*

assumptions, Information design discipline, Information design foundation, Information design genus, Information design guidelines, Information design objectives, Information design perspectives, Information design principles, Information design research, Information design roots, and Information design rule.

Information design areas. Information design includes areas like communication design, graphical user interfaces, information ergonomics, informative layout, scientific illustration, technical communication, technical illustration, technical writing, visual interface design. Here the main intentions are to provide information materials needed by the receiver in order to perform a specific task. The interpreter/s may develop new skills, understanding, and experience. Information design does not primarily include areas like advertising, entertainment, fine arts, news or propaganda.

Information design assumptions. 1) The designer must have a clear idea of what the user need to understand. 2) The “best” information set is effective, efficient, and appealing. 3) Many different media may be used for distribution of a specific information content. 4) Users must be active rather than passive. 5) Evaluation should include the information set as well as the performance of the user. 6) Users should be evaluated in terms of how they achieve the goals. 7) There should be a congruence among goals, reading, and assessment. Along with user’s characteristics and context, information goals should be the driving force behind decisions about activities and assessment.

Information design discipline. Information design is a *new academic discipline*, but it is not a new area of knowledge. It is based on cooperation between people with quite different backgrounds and experiences. See *Information design genus*.

Information design foundation. As an area of knowledge information design rests on a foundation, which can be expressed in four basic statements: 1) ID is multi-disciplinary. 2) ID is multi-dimensional. 3) Theory and practice co-operate in ID. 4) There are no firm rules in ID.

Information design genus. In order to satisfy the information needs of the intended receivers information design comprises analysis, planning, presentation and understanding of a message—its content, language and form. Regardless of the selected medium, a well-designed information material, with its message, will satisfy aesthetic, economic, ergonomic, as well as subject matter requirements. Information design is complementary to information technology in the same way as architecture, or *architectural design*, is complementary to building technology. At present the genus information design includes three disciplines. They are named *Communication design*, *Information design*, and *Presentation design*. In the future it is quite possible that some universities will introduce very similar design subject matters and use other names. See *Areas of knowledge*, *Information design objectives*.

Information design guidelines aim to streamline processes according to a set routine. Guidelines may be issued by and used by any organization to make actions more predictable, and of higher quality. However, by definition, following a guideline

is never mandatory. See *Guidelines, Message design principles, Principles*.

Information design objectives. The main objective is to provide information materials needed by the interpreter in order to perform specific tasks. The information interpreters might be seen as “doers.” They may develop new skills, understanding, and experience. In the writing of *information design objectives* it may be an advantage to use verbs like *apply, arrange, assemble, build, change, code, complete, compose, conduct, construct, cut, demonstrate, develop, draw, explain, find, generate, get, identify, illustrate, install, label, locate, make, modify, name, operate, pack, paste, predict, prepare, produce, put, read, recognize, reconstruct, remove, revise, sort, specify, start, type, verify, and write*. These verbs all denote observable behaviour. An example of a performance objective for a manual may be: “80% of the customers should be able to install the new computer software within 15 minutes.”

Information design perspectives. In my view the six most prominent perspectives are: 1) areas of knowledge, 2) areas of design, 3) types of content, 4) types of representation, 5) parts of communication, and 6) message contexts.

Information design principles are universal. Like mathematics information design principles are not tied to the unique features of a particular language, nor are they tied to a particular culture. Information design is a worldwide consideration. Information design is multi-dimensional. See *Guidelines, Message design principles, Principles*.

Information design research has a pragmatic perspective on knowledge. Each research problem needs its specific research method. Research includes analysis of the problem, planning, study of literature, collection of data, analysis of data, interpretation and discussion, and publishing of the final report.

Information design roots. Information design has its origin and roots in 1) graphic design, 2) education and teaching, and 3) architecture and engineering, or rather construction and production. Here people have recognised the need for clear, distinct and trustworthy presentation and interpretation of verbal and visual messages.

Information design rule. The only information design rule is: "Respect copyright, and other laws and regulations related to information." See *Information design foundation*.

Information design theories frequently refer to descriptive theory and propositions. Their main functions are to guide the information designers in how to actually design, present and produce information sets. We may see information design as a "theoretical practice" or a "practical theory." It is a complex area of research and study.

Information designer, or *infographer*, largely works as a project manager. The task is to coordinate production of words, images and graphic design, but also the use of sound, light, space and time, for the presentation of information in different media. It can often apply to large and complex information projects. The information designer needs to have skills in writing comprehensible, clear and consistent texts, in creating clear il-

lustrations, and in creating a clear, transparent typography and layout that aids understanding and learning.

Information disciplines include computer science, human computer interaction, information architecture, information design, information economics, information ergonomics, information management, information processing, information processing, information retrieval, information science, information systems, information technology, information theory, library and information science, mass-communication, media and communication, persuasive communication, planned communication, psychological information theory, semantic information theory, and social information.

Information driven societies. Access to information and the ability to learn are the basic assumptions of information driven societies. A person that can learn faster and more than his adversaries are assumed to succeed. Learning drives the development of technology, behaviour, organization and business.

Information economics comprises research on the business development of information industries. There are a lot of information jobs in all kinds of work places, and an increasing number of employees are working with information. Other areas of research are the impact of information and communication, the application of information technology in the work place, the history and geography of information labour and capital, the regulation and provision of information infrastructure, and the use of computers and networks.

Information elements. Information content is divided in small units, information elements. These are linked to objects

and can be managed in computer systems (information management systems, IMS). An information element may be a paragraph of text, a table, or a picture. Sometimes these elements are called information modules. See *Reusable design*.

Information ergonomics comprises research and development of the ergonomic design of man-machine systems. The design of an information system must be based on studies of the user's aims, knowledge, experience, and way of working. Tasks making particularly heavy information demands occur in work at computer terminals, work at complex information panels, and in signal systems (e.g., for the monitoring of industrial processes and tools). Information ergonomics include lighting, design of instrument panels, video display units, characters, symbols, signals, etc.

Information ethics. As a rule the information designer *must respect copyright* as well as other laws and regulations that are related to design, production, distribution, storage, and use of information materials. This concerns the use of artwork, illustrations, logos, lyrics, music, photographs, specific sounds, symbols, text, and trademarks. It is also very important to respect different ethical rules, media-specific ethical guidelines, and honour all business agreements.

Information graphics. A particular message is sometimes presented through the purposeful integration of text, pictures, and graphic design into a clearly delineated and structured area, i.e., a functioning whole. They are good in conveying a survey of a situation.

Information interpreters. See *Receiver groups*.

Information layout differs from a *decoration layout* in which purely aesthetic aspects are allowed to predominate. When illustrations in textbooks are not relevant to the prose contents, they do not facilitate the understanding of the text. On the contrary, illustrations can actually have a negative effect on reading comprehension and prose learning. Therefore illustrations should not be used only for decoration in information and learning materials. Today many visuals are too complicated and would communicate better if designers valued simplicity over decoration. Aesthetically pleasing visuals may deceive the learners about their instructional value. There are many situations where colour and typographic elements can be used for decoration. However, a decorative use of colour or typography should never be mixed with the intended use to provide clear structure, simplicity and hierarchy. It must always be clear and easy to understand for the receiver when colour and typography is used for decoration and when the use is meant to have some cognitive importance.

Information literacy has been defined as the ability to access, evaluate, and use information from a variety of sources. An information-literate person must be able to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information. See *Information competence, Information literate person*.

Information literate person is one who: 1) Recognizes that accurate and complete information is the basis for intelligent decision-making. 2) Recognizes the need for information. 3) Formulates questions based on information needs. 4) Identifies potential sources of information. 5) Develops successful search

strategies. 6) Accesses sources of information including computer-based and other technologies. 7) Is a competent reader, evaluates information, and determines accuracy and relevance. 8) Recognizes point of view and opinion versus factual knowledge. 9) Rejects inaccurate and misleading information. 10) Organizes information for practical application. 11) Integrates new information into an existing body of knowledge. 12) Uses information in critical thinking and problem solving. See *Information literacy*.

Information management, IM, comprises research and development of management of information in organizations. Information is divided in small units, sometimes called information elements. These elements are linked to objects and can be managed in computer systems, information management systems (IMS). An information element may be paragraphs of text, a table, or a picture. Sometimes these elements are called information modules.

Information material. In all parts of message design it is important to make a clear distinction between the actual content, the message itself, and the representation of that message. This representation is often called *information material* or *information set*. It is intended for a specific target group. It is devised in a specific fashion. It has a specific purpose and is distributed with the aid of a medium. See *Information box, Information material groups*.

Information material groups. There are seven distinct groups of information materials: 1) Advertising and propa-

ganda. 2) Informative entertainment. 3) Brief messages (Simple instructions, Prohibitions, Information, Warnings). 4) Administrative documentation (Working materials, Administrative messages, Business documents). 5) Factual information (Facts, Descriptions, Reports). 6) Instructions (Operating instructions, Production and maintenance documentation, Good advice, Interfaces, Recipes, Guidance), and 7) Teaching aids.

Information messages can be divided in different categories, such as numerical, verbal and visual. There are several systems for classification of message content, which is evident in a library.

Information navigation. It is possible to distinguish between different categories of variables, or “dimensions,” related to navigation, browsing, and search for information in multimedia systems, as well as in other information systems. Navigation is a goal driven search for some specific information, usually in a database or in a multimedia system. Navigation is a combination of visual, “human” browsing and computer based search. Browsing is a rather ad hoc, random way for a visual, “human,” search for information.

Information navigation diagrams show how different media are related. Every representation can be categorized by assigning a value for each of four dimensions: 1) *Type of search* (restricted—flexible). 2) *Experience and perception* (directed—associative). 3) *Structure and organization* (linear—non-linear). 4) *Type of signs and code-system* (abstract characters—images). The diagram can be used to analyse existing information systems, and predict characteristics of new systems. In an

ideal information system it is easy to browse, navigate, and search for information.

Information needs. In order to satisfy the information needs of the intended receiver's message design comprises analysis, planning, presentation and understanding of messages—their content, language and form. Regardless of the selected medium, a well designed information set will satisfy aesthetic, economic, ergonomic, as well as subject matter requirements. Information design is a multi-disciplinary, multi-dimensional and worldwide consideration with influences from areas such as language, art and aesthetics, information, communication, behaviour and cognition, business and law, as well as media production technologies.

Information perspectives. We may view information from various perspectives with respect to how we create, present, produce, distribute, search, sort, index, store, receive, process, value, respond to, make use of, and renew information. Often several groups of people with different skills are needed for these activities. Each person has a set of individual experiences and values that will influence their views of information

Information processing is a discipline comprising the processing of information so as to yield new or more useful information. Researchers use mathematical and numerical analysis plus methods and techniques for administrative data processing. The discipline also comprises the study of information searches in databases, information systems, computer-aided translation, computer aided education, computer aided problem solving, computer aided design, etc. The term information pro-

cessing is often used as a synonym for data processing, i.e., the execution of a systematic series of operations on data. The term is also sometimes used for studies of the way people process information mentally.

Information product refers to a physical representation of a specific message. The primary purpose is to convey this message to a specific target group. Examples of *primary information products* are posters, brochures, instruction booklets, instruction programs on video and manuals. Examples of *secondary information products* are daily newspapers with informative graphics, magazines with recipes, instructions and packaging with declarations of contents, descriptions and instructions. The primary purpose here is always something other than conveying information. Conveying information is a secondary purpose.

Information quality. When a document is to be read and understood by several people, there is reason to expend effort on achieving information of good quality. When this is achieved, we can discern the information's aesthetic, informative, pedagogical, and technical qualities, and sometimes even its entertainment value. *Good information quality* can be defined as the degree of congruity between the sender's and the receiver's subjective perceptions of the information, as well as of the reality that the information represents. By investing resources in improving the quality of information, we can achieve better product and project quality, while, at the same time making large cost savings. See *Quality, Information costs*.

Information retrieval (IR) comprises actions, methods, and procedures for tracing of data and information stored in computers, libraries, etc. in order to provide information on a given subject. Information retrieval is also a part of information science, but is sometimes considered a research area of its own.

Information rights. Access to information is vital to the development of students' potentials. The Association for Teacher-Librarianship in Canada believes that all students should have the right to: Access a wide range of print, non-print and electronic learning resources at an appropriate level; Explore materials expressing a variety of opinions and perspectives; and Freely choose reading, viewing and listening materials for recreational and study purposes.

Information science, IS, Library and information science, LIS, is an interdisciplinary area of research. It comprises the study of information in general, information management, information needs, information policy, information seeking, information structure, information technology, information theory, information users, intellectual property, metainformation, and visual information.

Information sector. The labour market's traditional subdivisions have changed strikingly in recent decades. The number of people employed in the information sector has risen from less than 5% of all the gainfully employed people in the U.S. in 1860 to more than 50% in 1980.

Information security is about risk management. In order to achieve risk management, all elements such as aims, attributes,

characteristics, principles, qualities etc should be taken under account based on availability, confidentiality, and integrity.

Information set. In information design the final designs may be called information materials or information sets. See *Information material*.

Information society is dominated by the resource information instead of the traditional resources energy, raw materials, labour, and capital. Our thinking power is supported by computer systems and modern telecommunications techniques.

Information structure. Readers have difficulty understanding the organisation and structure of text when there are three levels, or even or fewer levels. Usually four levels are too much. However, in scientific and technical documentation more levels may often be required.

Information systems, IS, comprise studies on development, use, and evaluation of computer-based information systems in various kinds of organisations. The social contexts where these systems are used are important areas of research. Introduction of new information systems usually cause changes in the traditional work processes as well as reorganisation of the administrative routines and organisations.

Information technology, IT, comprises research and development of the technical systems used for making production, distribution, storage, and other information handling more efficient. This includes computer technology and electronics. The term information society is sometimes used in information technology. See *Information age* and *information society*.

Information theory comprises quantitative measurement of transmitted information and comparison of various communications systems, especially in telecommunications. The contents lack inherent interest. Information theory is based on a mathematical theory presented in the 1940s by the American mathematician Claude E. Shannon. It subsequently came to be known as the Shannon and Weaver mathematical communications model. See *Shannon and Weaver*.

Information visualization usually concerns use of computers to explore large amounts of abstract data. Practical applications involve representing of abstract data in ways that facilitate human interaction. See *Data visualization, Visualization*.

Informational literacy is the ability to obtain information from the media and to judge its accuracy concept.

Informative drawings is a schematic picture with figures and objects. See *Drawings*.

Innumeracy refers to a lack of ability to reason with numbers. See *Numeracy*.

Informative entertainment is a term for a category of information materials. See *Infotainment*.

Informative layout. In contrast to traditional “artistic layout” an informative layout has a practical purpose, rather than. Text, pictures and graphic design work together to form a message that is easy for the reader to receive and understand.

Informative text. The term ‘text’ when used in descriptions of the seven groups of information materials refers to words, pictures and shapes. So the concept ‘informative texts’ refers to the sum of 1) informative words, 2) informative pictures, and 3) informative graphical shapes.

Infotainment, *informative entertainment*, refers to materials designed to entertain. Such material should enable the reader to relax, obtain recreation, pleasure and enjoyment for the moment without making any major demands on her/his mental activity to achieve a deeper understanding.

Initial letters. Sometimes initial letters are larger than the running text. Initial letters may be lowered as “drop caps” or raised as “raised initial letters.” Because of the possibility to create fancy initial letters in desktop systems, this medieval practice is becoming common again. Fancy initial letters are not likely to help readers.

Ink-jet printers. An ink-jet printer is an impact printer where the characters are formed by an ink jet on normal office paper. The ink-jet printer does not work with raster-dots but varies the number of ink drops within a given area. Few drops give light colours. Many drops give darker colours. The system is thus creating the same kind of effect as the systems working with halftone pictures. Many ink-jet printers work with pictures printed out with a resolution of 200-250 dots per inch.

Inner context is an internal context. In a book it is the relationship between various text elements, pictures and layout. We may also discuss the relationships between the image elements within a single picture. When we view a film or a television pro-

gram our attention is either on the image or on the sound. We may not be able to attend to more than one stimulus at a time. See *Context perspective*.

Inner orientation functions. As well as light can articulate space, texture, and time; it can also articulate inner orientation functions. In motion picture and TV production, light, especially combined with music and sound effects, can evoke a great variety of specific feelings and emotions within us. Minor position changes of principal light sources may have drastic effects on our perception of mood and atmosphere. For example, a face lighted from below may appear brutal, dramatic, ghostly, mysterious, and unusual.

Inner reality. Visuals used for information and in instructional message design are usually representations of our external reality. However, fine arts are sometimes representations of our inner reality, such as thoughts and dreams.

Instruction. Several definitions of the term "instruction" have been used in various discussions about the areas instructional design, instructional message design, and instructional technology. These areas of knowledge are all closely related academic disciplines. One definition of the term instruction is "Deliberate arrangement of experience(s) to help a learner achieve a desirable change in performance; the management of learning, which in education and training is primarily the function of the instructor." Another definition: "Bringing about by means of a well-defined method, that, under given conditions, a learner within a system, will reach a predefined goal." And a third defi-

nition: “Instruction is the intentional facilitation of learning toward identified learning goals.”

Instruction design, InD, as an umbrella term in order to bring related instruction areas together. Instruction design includes parts of the areas audio-visual instruction, educational technology, instructional technology, visual literacy, technology of instruction, instructional design, instructional message design, and design of instructional materials. Instruction design includes main aspects from areas dealing with *instruction* and *learning*, but from different perspectives, and with different emphasis. In instruction design the receiver is (normally) supposed to *learn* from the message. The main intentions are to provide courses, lessons and materials *intended for learning*. The interpreter/s may develop new understanding, experience, comprehension, knowledge, insight, and finally wisdom. We can note a paradigm shift from the old and traditional focus on teaching to a focus on learning. See *Areas of knowledge, Instruction design objectives*.

Instruction design genus. At present the genus instruction design includes three disciplines. They are named *Instructional design*, *Instructional message design*, and *Instructional technology*. In the future it is quite possible that some universities will introduce very similar design subject matters and use other names.

Instruction design objectives. The main objective is to provide courses and learning materials needed by the interpreter in order to modify behaviour with respect to learning. The information interpreters might be seen as “learners.” They may de-

velop new understanding, experience, comprehension, knowledge, insight, and finally wisdom. It may be an advantage to use verbs like *apply, arrange, complete, compose, conduct, construct, define, demonstrate, explain, find, identify, illustrate, label, modify, name, predict, prepare, recognise, reconstruct, revise, specify, verify, and write* in the writing of instruction design objectives. These verbs all denote observable behaviour. An example of a performance objective for an exercise may be: 100% of the students should be able to complete the exercise within 15 minutes. See *Information design objectives*.

Instructional design, *Instructional systems design, ISD*, may be seen as an outgrowth from instructional technology. Models of instructional design have descriptive, prescriptive, and/or explanatory elements in varying degrees. Instructional design theories provide principles for the design of instruction. In a few cases they intend also to provide teachers with prescriptions. Although design theories frequently refer to descriptive theory and propositions, their main function is to guide the designers on how to design and how to produce courses and lessons. When a designer is to solve an instructional problem, he or she will use the available knowledge about the system and the conditions at hand, and vary the method variables in such a way and toward such values that the desired outcome is achieved. Main variables are methods, outcomes, and conditions. There are a number of definitions of instructional design. Many instructional design models are based on the five phases in the ADDIE model with: Analysis, Design, Development, Implementation, and Evaluation. See *Instruction design genus*.

Instructional designer. See *Instructional technologist*.

Instructional illustrations have good readability when the subject matter is familiar to the audience; the subject matter is depicted in a realistic manner; it lacks excessive image detail that may distract from the main message; and the pictorial conventions are familiar to the audience.

Instructional message design refers to the process of manipulating, or planning for the manipulation of, a pattern of signs and symbols that may provide the conditions for learning. It is assumed that practitioners in this domain can be more effective if they make use of appropriate generalised research findings from the behavioural sciences. Here the term instruction refers as well to classroom contexts as to more informal contexts where attitudes, concepts, and skills are communicated. See *Instruction design genus*.

Instructional system includes units of programmed instruction.

Instructional systems design. See *Instructional design*.

Instructional team is a group of people working together to solve an instructional problem. The instructional team, with an *instructional technologist* (designer), a subject matter expert, and a producer working together, was conceived during World War II. See *Instructional technologist*.

Instructional technologist, or *instructional designer*, is a person working with *Instructional technology*. World War II had created an enormous instructional problem. Thousands of military personnel had to be trained rapidly to perform thou-

sands of specific tasks, critical to their own survival and the war effort. Agencies within the armed services produced a large number of instructional media, like instructor's manuals, filmstrips, slides, audio recordings and also motion pictures. During the process of creating military training films the new role of the *instructional technologist* emerged. This specific role emerged as distinct from that of the *subject matter expert* and the *technical expert* in filmmaking. The need for a professional who could contribute expertise in education to the knowledge of the subject matter expert and the technical expertise of producers was clear to the military staff. Thus the *basic instructional team*, with designer, subject matter expert, and producer working together, was conceived. See *Design team*.

Instructional technology. The knowledge area *audio-visual instruction* evolved into *educational technology*, which evolved into *instructional technology*. The term *instructional technology* was introduced in the 1960s as a description of methods and procedures of instruction used to promote the acquisition of knowledge and cognitive skills, mainly in classrooms and other formal learning situations. Instructional technology is a systematic way of designing, carrying out, and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication, and employing a combination of human and non-human resources to bring about more effective instruction. The purpose is to make education more productive and more individual, to give instruction a more scientific base, and to make instruction more powerful, learning more immediate, and access more equal. See *Instruction design genus*.

Instructional typography is the art and science of using individual letters, words, and passages of text to convey an instructional message.

Instructions is a term for a category of information materials that includes the six groups: 1) Operating instructions, 2) Production and maintenance documentation, 3) Good advice, 4) Interfaces, 5) Recipes, and 6) Guidance. This category differs from the category *Brief messages*, which comprises simple instructions, prohibitions, information and warnings, by demanding more comprehensive action in multiple stages. The purpose of instructions and directions is to enable the user to perform some concrete task. We can use the following in achieving this purpose: directions, drawings, explanatory texts, instructive texts, prose, prose, subject indexes, symbols.

Instructions for use. Users of all kinds of appliances often expect to be able to use the specific appliances without first reading any instructions for use. When people fail and realize that they need instructions they expect to be able to follow a clear text with pictures, a well-developed index, as well as a trouble-shooting guide. This is, however, usually not the case. Manuals may be hard to understand and they do not always meet even modest quality expectations. Modern computer systems often have user interfaces based on symbols intended to function in various countries, in various cultures and subcultures. These symbols may, however, actually not function at all for the intended users.

Instructive elements. Apart from arrows, lines and pointing hands most instructive elements were introduced after World

War II. Some instructive elements are “statements” comparable with individual words or even sentences.

Instrumental conditioning. See *Operant conditioning*.

Intaglio. In intaglio, or gravure, the image areas are below the surface in “ditches”, and ink is removed from the non-printing areas by the scraping action of a metal blade. There is several gravure printing technologies. See *Aquatint, Copperplate engraving, Dry point etching, Etching, Gravure, Mezzotint*.

Intelligence has been defined in many different ways. We have at least seven different types of intelligence. Linguistic intelligence and logical-mathematical intelligence are very highly valued in traditional education. Other kinds are kinaesthetic intelligence or physical intelligence, interpersonal intelligence or social intelligence, intrapersonal intelligence or introspective intelligence, musical intelligence, and spatial or visual intelligence.

Intended messages. An intended message may consist of specific ideas, thoughts, data, information, or some subject matter facts. An originator has got an “intended message.” An information designer assists him or her. During this process the designer creates a “perceived message” and a number of sketches. After some discussion they agree on a “preliminary message.” The original include a “designed message.” After production “mediated messages” will be distributed. Each person looking at the final design will create an “interpreted message.”

Intended receivers. See *Receiver groups*.

Intensity. See *Saturation*.

Interaction design, *IxD*, is the practice of designing interactive digital environments, products, services, and systems. The main focus is on satisfying the desires and needs of the intended users. Behaviour studies and new designs improve the possibilities for easy interaction.

Interactive video programmes, multi-media presentations, and i-PODs make it possible to combine sound and moving pictures in various ways. Thus, these media can arouse considerable activity, enjoyment and commitment in the user. Because an interactive video programme and a multi-media presentation can stimulate the user to perform at a high cognitive level, it has the potential to function well, both as a conveyor of information and as a teaching aid.

Interest. Scale, contrast, and colour may add visual interest to a design.

Interest/Perception. In a world in which it is becoming increasingly difficult to avoid unsolicited information and, at the same time, increasingly difficult to find information we really wish to find, our interest in material may be decisive to the way in which we perceive that material. Interesting material arouses our emotions to a greater extent than material we regard as boring. The degree of interest can be described with a rating between “no interest at all” and “maximum interest.” So the interest factor is one way to define the viewer’s relationship to picture contents. When interest is zero, our emotional response is negative or, possibly, indifferent. Emotional response increases as the interest factor increases and becomes increasingly positive. However, a given picture may evoke different emotional

responses in different people, even when they share a common degree of interest in the picture. Different people also perceive the interest factor in different ways. As is the case with the Redundancy/Information/Communicative impact model, the Interest/Perception model may be hard to use in practical work.

Interesting information. See *Information cone*.

Interface. An interface is the visible piece of a system that a user sees, hears or touches. Modern systems for information technology often have user interfaces based on symbols and images. These systems are intended to function in various countries, in various cultures and subcultures. We now belong to a society experiencing technological advances that promote the importance of the visual medium for message transmission and knowledge representation. This is a paradigm shift offering both opportunities and challenges. See *Fixed interfaces*, *Graphic user interface*.

Interface design. Whenever possible an interface should compensate for human physical and cognitive limitations. It should be “transparent.” The interface itself should not overload the user with complexity. It should be consistent. The physical components of the interface should be ergonomically designed, taking into account the comfort and health of the user as well as her or his needs. Non-command interaction styles such as direct manipulation and menus are preferable to command languages, although the expert user should be given “type ahead” capability to quickly move through layers of menus. The interface should handle errors by providing simple and concise error messages that assist the user in recovery and future avoidance.

Interior design is the design of effective settings for human activities in interior space. The work includes conceptual development, project management, and execution of the design.

Interline distance, *interline spacing*, *line space*, *vertical spacing*, is the vertical distance between the baselines in a text. A 10-point text may be set on a 12-point line in Times. This is written as 10/12, and read as “ten on twelve.” As the line length increases, the need for more leading and larger type increases. For maximum legibility of the running text in a book a line with 12 point type needs an interline distance of at least 2 points (Times) and 3–4 points (Georgia). Generally speaking, one can use the type size plus 15–30 % to determine this ratio. However, texts on overhead transparencies, in Power Point, and on wall charts need more space between the lines. Children and inexperienced readers need more leading than experienced readers. See *Leading*.

Interline spacing is the vertical distance from one baseline to another in a text. See *Leading*, *Interline distance*.

Internal access. In order to provide access to relevant facts and information contents within a specific information material the information designer should: Create appropriate indexes and other search systems. Provide a clear contrast between figure and ground. Provide a supporting context for important information contents. In printed books, reports, et cetera it is a good idea to have a list of contents, and one or more indexes. Various indexes, such as a list of illustrations, a list of artists, a list of photographers, a list of references, and a subject matter index with references to page numbers may be very useful.

These indexes are easy to compile using modern word processing programs. In computer based systems it is possible to provide automatic search systems for words, for parts of texts, as well as for pictures. See *Information access*.

Internal context. In books internal context is the interplay between text and illustrations, the interplay between illustrations and layout. Movies and TV programs have sound with speech, music, and sound effects plus visual and audio metaphors. See *Context perspective, Inner context*.

Internal textual structuring refers to the techniques used to organize, sequence, and provide an internal framework for helping readers understand the prose content. These techniques include signalling the text structure by using organization, verbal cueing, introductions, topic sentences, transitions, pointer words, and summaries.

Internalized message. When a message is internalized the receiver has got new emotions, new experiences, new feelings, and new knowledge. Often individuals will interpret the same representation in different ways. Here age and gender, cultural, economical, historical, political, religious, and social factors may be important. The internalized message will influence the interpretation and understanding of future and related messages.

International Institute for Information Design. See *IIID*.

International Reading Association, IRA. In recognition of the unique psychology and neurology of adolescence, distinct

from the literacy development of younger readers or adults IRA has outlined guiding principles of literacy development.

International Visual Literacy Association. See *IVLA*.

Internet-based training, *IBT*, is a kind of E-learning. See *E-learning*.

Internet. Development of graphic browsers is gradually changing the Internet from text-only communication to a powerful multimedia platform. In the production of information and materials for learning, a sender conveys information on a part of reality via a representation to an information receiver who, via sensory impressions, is able to obtain a perception of that specific part of reality. This perception may then evoke responses that affect reality and create feedback to the original sender. In this case the receiver becomes a sender, and the sender becomes a receiver. Actually, both the sender and the receiver are involved in several activities when a message is communicated.

Interpersonal intelligence, or *social intelligence*, is the ability to relate to others. This is the kind of ability that seems natural with salesmen, motivators and negotiators. Intrapersonal intelligence or introspective intelligence is the ability of insight, to know oneself—the kind of ability that gives some people great intuition. This is the kind of ability that lets you tap into the tremendous bank of information stored in your subconscious mind.

Interplay of visuals. In many situations it is a good idea to use more than one visual to be able to convey information. We can use image pairs or sequences of images.

Interpretand. See *Sign*.

Interpretation of art. See *Philosophy of art*.

Interpreted message. See *Intended message*.

Interpreting image content. We know that visuals are perceived much more rapidly and readily than text. Visual messages stimulate both emotional and intellectual responses.

Sometimes image-enhancements intended to improve the interpretation of image content get in the way of the actual message. It is easier to learn left to right sequences than the other way around.

Introductions to chapters in a book or to articles in a magazine or a newspaper are very often set in different type than the following running text. Sometimes the introduction is set with larger type size, sometimes in italic or bold typefaces.

Iohannes Amos Comenius. See *Comenius*.

Ionic is a classical newspaper typeface.

IRA. See *International Reading Association*

Irrelevant relationship. Here the pieces of information presented in various channels are completely independent of one another. In television programmes, for example, the picture sometimes deals with one aspect, the text with another, and the sound with a third. This makes it very hard for viewers to make the most out of the programme. Conflicts readily arise between a concrete visual event and abstract verbal information. When this ever happens, the concrete and readily accessible informa-

tion assumes priority over the abstract information. See *Modality*.

IS. See *Information science*, and *Information systems*.

ISD. See *Instructional design*.

ISO paper sizes are based on a single aspect ratio of the square root of two, approximately 1:1.4142. The base for the system is the AO paper. An AO (A zero) paper has an area of 1 m², with the sides 841 and 1189 millimetres (33.1 in × 46.8 in). The *A-series* can be traced back to a French law from 1798 for certificate papers.

Isopleth is a schematic picture. See *Maps*.

Isotype system chart is a kind of diagram where each icon represents a given quantity. See *Diagrams-*

IT. See *Information technology*.

It depends. Maybe the situation for information design can be expressed as: “it depends.” In each specific case an information designer must be able to analyse and understand the information problem, and find one or more practical design solutions.

Italic, *italics*, *italic print*, *italic type* are members of a family of type in which letters slant to the right. Italics are designed to complement the normal vertical design. It is read more slowly than regular type and is also disliked by many readers. See *Emphasis in text*, See *Manutius*.

IVLA. The International Visual Literacy Association, IVLA, was established as a non-profit association incorporated in the State

of New York in 1968 to provide a multi-disciplinary forum for the exploration, presentation, and discussion of all aspects of visual communication and their various applications through visual images, visual literacy, and literacy in general. IVLA serves as the organizational base and communications bond for professionals from various disciplines that are interested in visual literacy. Other concerns are to encourage the funding of creative visual literacy projects, programs, and research, and to promote and evaluate projects intended to increase the use of visuals in education and communications in general.

IxD. See *Interaction design*.

J

Jacket or *dust cover* is the paper wrapper of a hardbound book.

Japanese. Japanese is a complicated language, probably unrelated to any other tongue. Words borrowed relatively recently from Chinese and European languages (English in particular) have been adapted to the Japanese phonetic system, but many of them remain recognizable. In Japanese many inflections share the same explicit significance but differ in implicit meaning, depending on the prevailing social and other circumstances. Japanese script is said to comprise about 48,000 different characters, *kanji*, designating different words. Each kanji character can be written in three different fonts and has two or often more meanings, sometimes as many as 15–20. Combining different kanji characters can create a large number of new words and concepts. In elementary school, children learn the 996 most important kanji characters. About 1,850 kanji characters are used in the basic set employed in daily newspapers. A few thousand more are used on special occasions. Few people in Japan are able to read and write more than 10,000 kanji characters. Japanese children must spend a lot of time and effort on learning to read and write, since their language is so difficult. In addition to kanji, Japanese has *kana*, a 48-character syllabic language. These characters are used in two versions, *katakana* and *hiragana*. Kana writing is used for various inflective elements and for the phonetic writing of, e.g., borrowed words. *Signs and words.*

Jelling. The large Jelling stone is a three-sided pyramid, and 243 cm high boulder of granite. The weight is ten tons. This rune stone is often called “The certificate of baptism for Denmark.” It is an artefact showing the transition from Old Norse religion to Christianity. It is possible that the work started 965 and was completed by 986. King Harold wanted to honour his parents. Side A has a text about himself and his parents. The text continues on the other sides. Side B has a large four-footed animal and animal ornamentation. Side C has a picture of the tied up, but winning Christ. King Harold used text, images and graphic form to mediate three messages about power and religion to the subjects in Denmark: 1) I, King Harold, honour my father Gorm and my mother Thyra. 2) I, King Harold, won and now govern the whole of Denmark and Norway. 3) I, King Harold, turned the Danes to Christianity. I am the friend of God. The Danes are now loyal subjects to me and to God.

Jenson. To a large extent the history of graphic design is parallel to the history of art and the history of illustration. The French printer *Nicolas Jenson* (1420–1480) studied the art of metal movable type under Johannes Gutenberg in Mainz. Later he carried out most of his work in Venice, Italy. Nicolas Jenson perfected the first Roman lowercase letter type already in 1471. He transferred Gutenberg’s imitation of handwriting to a printing style that is still used.

Jim dashes are short cut-off rules that separate unrelated items above and below the line.

Johannes Amos Comenius. See *Comenius*.

Jumbotron. At Tsukuba Expo '85 in Japan, Sony had built the world's largest video screen, 25x40 m, i.e., 1,000 m². The image was very bright and more than 50,000 people could see it at the same time. The jumbotron image is built up by 150,000 pixels called Trini-lite, which are 80 x 45 mm. Every pixel consists of one blue, one red, and one green part. The jumbotron image is more than two million times larger than, for example, a wrist-television.

Just noticeable difference, or *differential threshold*, is the least possible difference that can be detected between two similar stimuli.

Justified text. Authors argue that *justified text* is aesthetically pleasing and that it is easier for people to read lines of the same length than reading lines with markedly varying right-hand ends. Readers may even feel that ragged right-hand lines in "flushed left text" make an ugly and repulsive text column. If justified text is set in lines too short, there will be "rivers of space" between words, or characters spaced out to fill the lines. Results from reading experiments of justified and unjustified texts indicated a significant increase in reading time for the groups that read justified texts. There were, however, no differences in comprehension. Whether a text is justified or unjustified causes no significant difference in search time and comprehension of the information content for advanced readers. See *Unjustified text*.

K

Kaizen is the most important concept in Japanese management, and the key to competitive success. Kaizen means *ongoing* improvement involving *everyone*—top management, managers, and workers. It is a process-oriented way of thinking versus the innovation- and results-oriented thinking in the West.

Kana. See *Japanese*.

Kanji. See *Japanese*.

Keep it simple! Leave out needless words and needless pictures and picture elements. This does not mean that all your sentences have to be short, or that you have to avoid all detail.

Kern (verb) manually adjusting the space between characters to achieve better legibility; (noun) the amount of space added or subtracted in the process. See *Kerning*.

Kerning is used to individually correct the distance between characters. When a capital A and a capital T, V, or Y are set without kerning, there is too much space between the letters. The A, V, and Y have slanted shapes, and the T has empty space at the bottom. Kerning can create a better optical spacing between the letters. Kerning is important for headings in books, handouts, pamphlets, reports and other printed documents, and also for projected texts. It isn't worthwhile kerning any type under 18 points. See *Kern, Space between letters, Spacing*.

Keep it simple! Leave out needless words and needless pictures and picture elements. This does not mean that all your sentences have to be short, or that you have to avoid all detail.

Kinaesthetic intelligence, or *physical intelligence*, is the ability to use one's hands or body. A person in this category has exceptional control of his or her body, control of objects, good timing, trained responses, and good reflexes. He or she learns best by moving around and participating, and remembers what was done rather than what was said or observed. Kinaesthetic intelligence is highly developed in dancers, actors, athletes and sporting achievers, inventors, mimics, surgeons, karate teachers, racing car drivers, outdoor workers, and mechanically gifted *people*.

Kinaesthetic modality. Children with *kinaesthetic* or *tactile modality*, or both, rely very much on their movements and muscular involvement. They learn by doing, and remember what was done rather than seen or heard. Imagery is not important, nor pictures. Kinaesthetically oriented children prefer sculptures that they can touch. When communicating, these children use many bodily expressions. They respond to music by physical movements. See *Modality*.

Kite chart is a schematic picture. See *Diagrams*.

Knowledge. There are numerous competing and complex theories of *learning* and of *knowledge*. There is an on-going debate. For our purpose knowledge may be defined as 1) awareness and recognition of a person or a thing to be something, 2) having facts, information, intelligence and skills acquired by practical and theoretical understanding of a subject, 3) understanding of a subject matter with the ability to use it for a specific purpose, 4) the sum of what is known in a particular field. Acquisition of knowledge involves complex cognitive processes,

such as attention, perception and learning. These processes are influenced by our earlier experiences and our memories. Groups of brain cells are activated and associate to each other. Information is converted into experience and insight. Then experience and insight are converted into knowledge. Later, knowledge is converted into skills and attitudes—and eventually into wisdom.

Knowledge skills. Professional communicators possess rich schematic and tacit knowledge about genres, processes, stakeholders, symbols, and tools. This is knowledge that guides engagement with others and that influences their symbolic-analytic production of text. They are reflective on their knowledge and are able to devise tactics for learning what they need to know. Professional communicators are meta-cognitively aware of what they need to know and have strategies for getting that knowledge. They acquire rich knowledge of verbal, visual, and typographic text features and are skilled in combining visual and verbal resources. They can interpret what they need to know on the fly. See *Professional communicators*.

Knowledge visualization is often defined as using visual representations, such as diagrams, images, and sketches etcetera, to transfer knowledge. However, in my mind we can only transfer data and information. Each individual has to build knowledge internally.

Koffka. See Gestalt principles, Gestalt psychology.

Köhler. See Gestalt principles, Gestalt psychology.

L

La Grande Encyclopédie. The greatest early enterprise in visual information and in message design is the French encyclopaedia *La Grande Encyclopédie*. The first volume appeared in 1751 under the co-editorship of Denis Diderot (1713–1784) and Jean d'Alembert (1717–1783). The *Encyclopédie* was a huge undertaking that occupied Diderot as chief editor for a quarter of a century. The *Encyclopédie* exerted great influence throughout the world. It was a genuinely progressive work with seventeen volumes of text, supplemented by eleven volumes of illustrations. The *Encyclopédie* included 71,818 text articles with a total of 20 million words printed on 18,000 pages of text. Illustrations were designed and printed from 2,885 copper engravings. The illustrations are aesthetic and detailed, with overviews, crafts images and analytical catalogue images. Leading persons such as Montesquieu, Rousseau, Turgot, and Voltaire wrote articles for the encyclopaedia. The general attitude was liberal, tolerant, and above all, rational. See *Diderot*.

Language. Any system used as a means of communications between people can be regarded as a language. There are different languages, such as spoken, written, and visual. Languages differ in their ability to express concepts with precision and flexibility. Only people who have the appropriate knowledge can understand a language. Chemistry, mathematics, and physics employ non-ambiguous symbol and equation languages. Normal prose is often open to multiple interpretations, i.e., it is ambiguous. Fiction and poetry in particular offer abundant opportunities for individual interpretations. Pictures are normally ambiguous

too. See *Morphemes, Phonemes, Properties of verbal language, Providing simplicity, Providing structure, Syntagms.*

Language activities. *Speaking* and *writing* are language-related activities performed by the sender. These activities are influenced by the sender's earlier observations, and by the terminology and the language he or she uses. Besides being active, the sender is in charge of encoding the message, that is, its production and distribution. *Listening* and *reading* are language-related activities performed by the receiver. As is the case with the sender, the receiver's activities are influenced by his or her earlier observations, as well as by the terminology and the language he or she uses. Besides being relatively passive, the receiver is in charge of accepting and decoding the message.

Language classification. There are many approaches to language and language classification systems. (There are probably 5,200 living verbal languages, certainly no less than 4,500 and possibly as many as 6,000.) While linguistic scientists distinguish between spoken and written language, graphic designers distinguish between verbal and pictorial language. From a design point of view, written, printed, or displayed texts or verbal graphic language are important components of visible language. Visual languages attempt equivalence with reality. They are iconic and normally resemble the things they represent.

Language disciplines. There are many language disciplines, such as drama, graphic design, linguistics, rhetoric, semiology/semiotics, verbal languages, and visual languages. From a message design perspective the language aspects of graphic design are more important than the art aspects.

Lardent. See *Morison*.

Laser printers. A laser printer is an electrostatic device in which a laser beam is scanned across the surface of an electrically charged selenium coated drum. This is done with a rotating polygonal mirror. The charge of the drum surface is modulated according to the dot matrix character patterns. A whole page with text and images is built up by a page description language (for example, PostScript) and then transferred to a paper as in a conventional Xerographic printer. Laser printers often have had a resolution of 300 or 400 dots per inch. For these printers it is hard to reproduce more than a few grey levels. When printing many grey levels the dots get far too large and the resolution too poor as they are built up by available “dots”. However 1,200 dots per inch horizontally and 600 dots per inch vertically are enough for good reproduction of half-tone pictures. Most laser printers have one toner that mainly consists of black coal powder. There are also toners in blue, brown, green, yellow, magenta, cyan, and red.

Law of closure. See *Closure principle*.

Law of common fate. See *Common fate principle*.

Law of continuity. See *Continuity principle*.

Law of convexity, or convexity principle, states that convex patterns will be perceived as figures.

Law of good continuation. See *Continuity principle*.

Law of good Gestalt. See *Good form principle*.

Law of grouping. See *Grouping principle*.

Law of past experience. See *Past experience principle*.

Law of Prägnanz. See *Good form principle*.

Law of proximity. See *Proximity principle*.

Law of similarity. See *Similarity principle*.

Law of symmetry. See *Symmetry principle*.

Law suits. In the USA, there is an increasing incidence of law suits being brought against manufacturers. These law suits claim damages as a result of accidents occurring, or products breaking because of poor quality in the language of instruction manuals. The courts are demanding that technical manuals, brochures, information sheets, and labels be written in comprehensible language, and that descriptions and instructions be readable and legible. Everywhere, plaintiffs' counsels are searching frenetically for sections of text and parts of pictures that might be interpreted in conflicting ways. If a manufacturer's technical documentation is difficult to understand, he can lose a lawsuit and then have to pay large sums of money.

Layout. A finished layout is the practical result of the work in the graphic design process. The purpose of this work is to find a suitable presentation for the content with respect to the receiver, the subject matter, the medium, and the overall financial situation. Within a given area—such as a page in a book, a poster, or a label—the graphic designer may arrange and distribute text, pictures (drawings and photographs), and the background (margins, space, patterns, and designs without any significant picture elements). Layout provides a large number of possibilities to make the structure in a document clear. The

graphical form should help the reader to benefit from the contents of a document. See *Graphic design genus*.

LCD, Liquid Crystal Display, use liquid crystals. The LCD contains a liquid whose molecules lie parallel when an electronic current passes. Between polarizing filters the crystals then look dark. The technique is common in, for example, wrist watches. Here every element in the digits is connected so that it can be turned on and off. In larger screens there is a net of crossing semi-conductors behind the crystal layer. A dark dot appears in every crossing when the current is turned on. A picture is built up quite slowly. See *FLCD*.

LD. See *Light designer*.

Le Prince. The French inventor Louis Le Prince (1841 – 1890?) created the oldest surviving film in England in 1888. His film lasted two seconds and showed walking people.

Le Rond d'Alambert. See *La Grande Encyclopédie*.

Leading is the extra space between lines in a text. In a text 10/12 the interline distance is 12 points, and the leading is two points. Leading is important for legibility. The longer the lines, the larger the vertical distances have to be. The reader needs to be able to find the start of the next line without any trouble. Typefaces with small x-heights manage well with less leading than typefaces with large x-heights. See *Interline distance*.

Learner-centred instruction. It may be time to focus on learner-centred instruction rather than materials- or teacher-centred instruction.

Learning is complex. A large number of learning theories provide broad views of learning. I view learning and learning theories from a process perspective rather than from a traditional outcome perspective. Learning models may be grouped in six main categories from a process-perspective. These categories are 1) Perceptual motor-skill learning, 2) Associative learning, 3) Learning from analysis and problem solving, 4) Social learning, 5) Learning from representations, and 6) Combined learning. See *Learning from reading*, *Learning processes*, and *Learning styles*.

Learning from listening. We can listen in different ways, such as skim listening, surveying listening, search listening, and study listening. Most people listen only intermittently and select only things of personal interest. When we study and want to learn, we must take an active part in the content of the material.

Learning from multimedia. We only know little about the optimal combination of audio, speech, screen texts, and illustrations in multimedia used for education. Some studies demonstrate that spoken commentary is better than visual text seen on the screens. Learners learn better when the instructional material does not require them to split their attention between multiple sources of mutually referring information.

Learning from pictures. See *Learning from visuals*.

Learning from reading text is affected in the same way as comprehension. We learn to sequence information, and as a consequence, to think in linear, sequential ways. Perception of text means a sequential, slow processing to compose and comprehend the contents (“left brain activity”). Retrieval from

verbal memory is a serial integration and sequential processing of auditory-motor perception systems. One of the best-known techniques for improving memory from reading is called the PQRS method (Preview, Question, Read, Self-Recitation, and Test). The method is intended to improve students' abilities to study and remember material presented in textbooks. In the first step, the reader previews the chapter at hand to get an idea of its topics and sections, reading the chapter outlines, the section headings, and the summary. The second, third, and fourth stages apply to each section. What can be recalled is typically related to how well it was understood in the first place. Although a large number of studies have been devoted to the cognitive processing of single text passages, far less is known about the comprehension process in using multiple documents for learning.

Learning from visuals. The effectiveness of a visual depends on the medium, on the type of information, and also on the amount of time that learners are permitted to interact with the material. All types of visuals are not equally effective. Line drawings are most effective in formats where the learner's study time is limited. More realistic versions of artwork, however, may be more effective in formats where unlimited study time is allowed. The use of visuals does not always automatically improve the achievements of the learners. For some objectives text is enough.

Learning goal is a general statement for a topic.

Learning Helix. Attention makes us receptive to specific data and information in our environment (external context). We select and perceive information that we process into knowledge

with reference to our earlier experiences and memories (internal context). We apply and test for confirmation. Hereby, knowledge is internalized and influences new attention. Different learning processes are active at the same time. Information is processed into knowledge with continuous parallel and spontaneous learning. This is the “Learning Helix.”

Learning object is a self-contained learning resource with a single learning objective.

Learning objectives are specific expected outcomes for learning. Learning objectives are often derived from subject content and direct the selection of instructional activities and resources, and specify the way to test student learning. Learning objectives may increase the attainment of factual information, but do little to help students process higher-level skills.

Learning problem. The problem in learning new information is not getting information into memory; it is making sure that it will be found later when it is needed.

Learning processes. We can assume that there is more than one learning process involved while we are learning. Learning models may be grouped in six main categories: 1) Perceptual motor-skill learning. 2) Associative learning. 3) Learning from analysis and problem solving. 4) Social learning. 5) Learning from representations. 6) Combined learning. There are probably no distinct borders between different learning processes; they probably interact and work in parallel while information is processed into knowledge. Learning is parallel and spontaneous. Here attention, perception, processing, and application are the basic functions. The eye movements and fixations can be

guided and determined by a picture caption or by a spoken commentary. Meaningful material is learned more easily and remembered for a longer period of time than meaningless material. We are normally forced to make a continuous selection from the information that constantly bombards us.

Learning styles are affective, cognitive, and physiological traits that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment.

Learning theories. Some researchers are trying to develop a single comprehensive learning theory encompassing all the different kinds of learning. As far as I know no such attempt has yet been successful. There is no theory of learning that is widely accepted. Thus we have to deal with more than fifty theories and models of learning, and learning processes, each useful in its own context.

Ledger. The most commonly used paper sizes in North America are called *Ledger*, *Legal*, *Letter*, and *Tabloid*. A Ledger size paper is 432 x 279 mm (17 × 11 in).

Legal. The most commonly used paper sizes in North America are called *Ledger*, *Legal*, *Letter*, and *Tabloid*. A Legal size paper is 215.9 x 355.6 mm (8½ × 14 in).

Legend. It is possible to interpret most pictures in several different ways until they are "anchored" to one interpretation by a legend, or *caption*. See *Caption content*, *Caption form*, *Caption heading*, *Caption placement*, *Caption typography*.

Legibility is how easy it is to read a message. It is determined by the technical design of the text and the pictures, that is, their

clarity. A message has good *legibility* if it is easy to read, from the viewpoint that the reader should easily be able to see and distinguish all different parts. Legibility can be measured rather objectively, and its quality is assessable whether we understand the content of the message or not. See *Audibility*, *Clarity*, *Information costs*, *Legibility of colour*, *Legibility of layout*, *Legibility of maps*, *Legibility of numerical values*, *Legibility of pictures*, *Legibility of projected texts*, *Legibility of symbols*, *Legibility of text*, *Legibility of text on screens*, *Legibility of text on wall charts*, *Legibility/Reading value rectangle*.

Legibility of colour. Colour is regularly used in printed materials, not only in illustrations, but also in the text itself. The most legible combinations of print colours are black or dark brown text on a light yellow background. Black type on a white background gives the highest and most comfortable contrast for sustained reading. Other combinations may attract more attention but are less legible and, thus, require larger type. The legibility will always be affected when there is insufficient contrast between the type and the background.

The background colour of a computer screen should be “fairly light” or “fairly dark,” depending on the content. The text displayed on a screen should have an opposite (“fairly dark” or “fairly light”) colour. The most legible colour combination is black text on a white or yellow background.

Unfortunately, red and green are often used as discriminating colours in symbols and in warning signs. Since many colour-blind people perceive red and green as grey, colour can only be used to code the information redundantly. Colour may be com-

bined with shape, and position, or with both, which is often seen in traffic signs. See *Legibility*.

Legibility of layout. An “informative layout” must have good legibility. Here text, pictures and graphic design work together to form a message that is easy for the reader to receive and understand. Informative layout has a practical purpose in contrast to the traditional artistic layout, which may please the individual artistic graphic designer, but which has no relation to the content of the message.

The purpose of work with graphic design is to find a suitable presentation for the content with respect to the receiver, the subject matter, the medium, and the financial situation. A layout is the result of work with graphic design. Within a given area, such as a page in a book, a poster, a label, a computer screen, or a projected image the designer may alter the design of headings, margins, ornaments, pictures, space, symbols, and text. Deliberate typographic variation is used to present the content in the text in a clear way.

The observations on which the “Gestalt theory” is based form a basic part of the graphic designer’s craft knowledge. These principles might be seen as relatively inflexible “perceptual rules” that act as a fundamental constraint for the typographer alongside such conventional rules as the left-to-right direction of the writing system. See *Legibility*.

Legibility of maps. Maps must have good legibility. A graphic language used on maps consists of visual variables. The most important variables are position and place, form (of symbols), directions, colour, density or greyness, granularity or texture, and size of symbols. A variable can be a dot, a line, or an area.

Discriminatory responses to map symbols depend on contrast in *form, dimension, and colour*. The problem of discrimination is generally more critical in monochrome maps, in which only contrasts in form and dimensions are possible for lines and small symbols.

The use of colour on maps introduces a large number of variables, which may enhance contrast, and therefore extend the number of perceptual differences that can be employed in discrimination. The effect is to *aid legibility*, and therefore to increase the total range of information which the map can present. Shape and colour components are often used for designating a link or relationship between groups of messages. The recognition of geographic features is much enhanced when areas are differentiated by hue. At the same time, complex colour arrangements may raise problems in discrimination, so that although multi-colour maps enlarge the graphic possibilities, they also increase the probability of errors in the judgment of discrimination. The most common case of quantitative judgment on maps occurs in the use of proportional symbols, that is, point or line symbols constructed to represent specific quantities. See *Legibility*.

Legibility of numerical values. Numerical data and information can be presented in tables and in graphs. A table in an information material must have good legibility. Several researchers have studied design of tables aimed for the general public and other non-professional audiences. Generally speaking type size used in tables should be between 8 and 12 points. Readers prefer vertically oriented tables where it is easy to see the target entries, and then quickly find the data in the table

cells to the right. It is easy to compare “side by side.” Horizontally oriented tables are harder to use and more difficult to understand. It is complicated to compare “up and down.” Tables may show the maximum of amount of information in the minimum amount of space. However, tables are not always the best way to communicate numerical data.

In *friendly graphs*, words are spelled out, they run from left to right (in western societies), and data are explained. Elaborately encoded shadings, cross-hatching, and colours are avoided. Colours are easy to distinguish, type is clear and precise, and is done in upper and lower case with serifs. In *unfriendly graphs*, abbreviations abound, words run in many directions. Graphics are repellent and cryptic with obscure coding. The design is insensitive to colour-deficient viewers Red and green are used for essential contrasts, and type is clotted and in all capitals in sans serif. See *Legibility*.

Legibility of pictures is how easy it is to read a visual message. Pictures must have good legibility in all kinds of information and learning materials. Images shall be bold and large enough to see. They shall only contain essential information and have a good contrast between figure and ground and be appropriate for the intended audience. Graphics can help readers see and comprehend complex patterns. A picture can be rated according to legibility and reading value.

Legibility of projected texts. In verbal presentations, many of the overhead transparencies, slides, filmstrips, and projected computer presentations consist mainly, and sometimes only, of text. This type of slides has been named *reader slides* and *word visuals*. Here lettering must be considered carefully in order to

guarantee good legibility for all listeners. Since text must be legible also to all spectators who are sitting at the rear of the hall the minimum size of letters in overhead transparencies is six millimetres (Helvetica 18 points).

A projected slide should have no more than six lines of six words with a good contrast between foreground and background, without tonal background fills. The limited text on reader slides should have maximum legibility. It is important to maintain a good contrast between foreground and background. Good colour combinations are yellow–black, and white–blue. White–yellow, red–green, and red–blue are all very bad colour combinations.

Stylized and fancy typefaces should be restricted to opening slides. Upper-case letters are often used in slides, but it is better to use normal running text with lower-case letters. It may be a good idea to use a medium to medium-bold linear typeface such as Helvetica; for example 36 and 30 points for headings, 24 points for the body text, and 18 points for texts within illustrations

Before the presentation the presenter will need to reduce room illumination and clean slides, lenses, and screens. During the presentation it is important to really project the images in focus and on the screen, preferably horizontally. Slides should be projected in a correct way and not in any way be distorted. See *Legibility*.

Legibility of symbols. The use of symbols has a long tradition and various symbols can be used to aid communication. A clear and stable figure to ground articulation is essential in graphic symbols. The figure (“foreground”) should be organised as one

unit with close boundaries, appropriate line thickness and any other graphic means that help the visual system to organise the figure as one unit. Criteria for individual symbols or sets of symbols depend on their application. It is appropriate to use silhouette (side) views of certain components such as vehicles.

Legibility distance is essential in the case of traffic signs and many building signs, but not for symbols on maps or consumer products. Black text on a yellow background is superior as compared to white on black, white on grey and black on white. For warning signs it is important to use large, legible bold-faced alphanumeric characters. Complex warning messages need a combination of pictographs and words. Warnings must have high contrast relative to the background. See *Legibility*.

Legibility of text. The concept *legibility of text* refers to a text's external properties, and how easy it is to read short bursts of texts. These external properties are letter size, inter-line distance, line length, the distance between letters, the number of letters per line, the distance between words, the typographic style, the subdivision into paragraphs, headings, headings in the margin, the layout, colour of the printing ink and paper, the paper quality, etc. Furthermore legibility refers to production and material quality, environmental conditions, room lighting and temperature, noise level, et cetera. A printed text in books, handouts, reports and other printed documents must have good legibility. Also see *Legibility*, *Legibility of text on screens* and *Legibility of text on wall charts*.

Legibility of text on screens. Compared with traditional graphic presentations, a presentation of information on visual

displays such as television sets and computer terminals is very limited. Still, information may be presented in many different ways. The design may vary with respect to spatial organization like directive cues, colours, columns, headings, justification, lines, scrolling text, spacing, and twinkling characters or words. A text on a computer screen must have good legibility. Colours presented on colour displays are ranked in the same order as surface colours in traditional print media. The best combination is black text on a white or yellow background. It is also important to use typefaces specially designed for screen display, such as Trebuchet and Verdana. See *Legibility, Screen displays, Visual displays*.

Legibility of text on wall charts. Wall charts, mounted photographs, some posters, picture collages, and wall maps are usually excellent information and teaching aids, provided they are relevant to the content and context. Posters and wall charts shall be read from some distance. Therefore text should be large enough, and bold enough. Too small or too large lettering will impair reading. The text on a poster or a wall chart may often have to be ten times larger in size than a text in a book or on a print out. Text should be set in lower case letters, because all-capital printing has been shown to markedly reduce the speed of reading. Since the texts on posters and wall charts should be short it may be a good idea to use a sans serif typeface like Arial or Helvetica. If so the running text will need some extra space between the lines. See *Legibility*.

Legibility/Reading value rectangle. A picture can be rated according to legibility and reading value. First, the extent to which the picture is readable for the intended reader is rated.

Does the picture have considerable reading value and interest or does it have poor reading value and little interest? The picture's legibility is then rated. Is the picture distinct and easily read, or is it indistinct and difficult to read with a view to its execution? An informative picture with positive reading value and legibility is probably "very good." A picture is "good" if it is readable but difficult to read. The picture is "bad" if it has limited reading value and is easy to read but "very bad" when it has poor reading value and is also difficult to read. Initial experiments suggest that a preview test of this kind could prove to be very useful. See *Legibility, Readability*.

Letter 1. The properties of letters, *characters*, are limited. A letter has a given position in an alphabet. It has a name. It is represented by one or more sounds and is used in a specific context.

Letter 2. The most commonly used paper sizes in North America are called *Ledger, Legal, Letter, and Tabloid*. A letter size paper is 215.9 × 279.4 mm (8½ × 11 in). Letter size is also known as American Quarto.

Letter size. We should avoid unusual typefaces, as well as typefaces that are too small or too large. Typeface and font size must be adapted partly to the medium and partly to the choice of technical production. We read words in a text as "pictures," not letter by letter. In a book it might be sufficient to set the type between nine and twelve points, although on a display screen, the text should be at least three to five times as large. The text on a poster may need to be ten times greater in size.

Letterform is the design of individual characters of a typeface.

Letterhead is the top of a designed writing paper.

Letterpress. In the letterpress process the image carriers can be cast-metal type, etched-metal plates, or photopolymer plates on which the image or printing areas are raised and the non-image areas are below the surface of the printing areas. In the production of books photo-engravings used to be very common for the printing of illustrations. Photoengraving was first done in 1824. The screen principle was introduced in 1852. The first successful process-colour engraving was done in 1893. There are two kinds of photo-engravings: half-tone block and line cut. A half-tone picture is photographed in a reproduction camera using a raster to create a raster-image. The raster-image is copied to a photosensitive plate of zinc. The plate is etched resulting in a relief. Prior to printing the plate is mounted in the printing form. There are several kinds of letterpress printing machines, both sheet-fed and web-fed presses. Presses include the platen press, the flatbed cylinder press, and the rotary press.

Letterspace (verb) to add extra space between letters; (noun) the amount of extra space added.

Level of detail. Subject matter experts often spend far too much time and effort describing very small, and for them, “interesting” details because they happen to have easy access to information about these details. However, these details may be of no interest at all to the audience. Before starting to draw or write, it is important to decide which level of detail we need to work on. It is often quite important to avoid too many details.

Level perspectives. Starting from the highest level these perspectives are called bird's-eye perspective, military perspective,

gentleman's perspective, eye-level perspective, and worm's-eye perspective.

Leverage effect. In any new academic discipline and in any new specific area of knowledge it is hard to create a basic and unanimously shared and common body of knowledge. What can we do to start the process? What can we do to boost research in a specific area of knowledge? A new area of research may engage a number of individual researchers. However, these researchers may typically be working in several different parts of the world. Furthermore, they may be working individually on their own projects and their own research problems. Most of these researchers may not have any contacts at all with other researchers with similar interests. Some researchers may, however, occasionally have some cooperation with one or more other researchers.

Lexi-visual narrators shall consider the theme of the content, the pedagogical purpose, and the aesthetic form.

Lexi-visual products are the result of teamwork between subject matter experts, visualizers and editors.

Lexi-visual representations. Information materials often consist of text. Probably no other instructional device leads to more consistently beneficial results than does adding pictures to a text. There can be no doubt that pictures combined with texts can produce strong facilitative effects on retention and learning. These effects prove to be valid for a broad range of texts, pictures, learner characteristics, and learning tasks. Text and pictures must both be easy to read as well as complement and reinforce one another. Informative words need pictures, and in-

formative pictures need words. It is important that we use verbal and visual representations in an optimal way.

What we see is very important for our experience and perception of the world. Seeing is direct and effortless. Making and understanding visual messages is natural to a point. However, effectiveness in visual literacy can only be achieved through learning. And the ability to read and understand pictures is learned. This learning takes place more rapidly in a culture where pictures are used and seen frequently. Pictures reinforce our knowledge when they are close to the real experience. Most people have a preference for visual information.

The analysis of a “pedagogic text” includes the text as well as the pictures. A pedagogic text is produced to work in education and training. It can be a textbook, but also a film, a series of slides or any other form of teaching aid.

Lexicology is the science that deals with the structure of vocabulary.

Lexicography is both the study of how dictionaries are compiled and the actual process of compiling and writing them.

Library and information science. See *Information science*.

Lifestyle is a term often used in advertising to describe groups of receivers on the basis of social and psychological factors. Psychologists and sociologists conduct comprehensive interview studies to elucidate the needs, behaviour, expectations, values and wishes of different groups.

Ligatures. Ligatures are letters combined to new characters. Examples are Æ (A+E) and Œ (O+E).

Light. The physicist defines light as visible radiant energy. Actually, light is invisible. We can see it only at its source and when reflected. Light will articulate our outer orientation with respect to space, texture, and time. Light is essential to the appreciation of three-dimensional images like sculptures. Whether the light is coming from the left or from the right, the top or the bottom, makes a crucial difference in the appearance of the forms. Soft light helps us appreciate subtle undulations. Strong light accentuates details on the surface. See *Lighting conditions, Light waves, Shadows.*

Light design, lighting design, is the use of light and lighting to create different atmospheres in art installations, concerts, opening and closing ceremonies of sports competitions, public celebrations, theatre plays, water sculptures etcetera.

Light designer, LD, may work in a theatre with lighting in order to create atmosphere, and time of day in the production. The sculptor Bernini used light as an important metaphorical device in his religious settings. He unified sculpture and richly polychrome architecture and the carefully effects of designed light. One of his most important works is the sculptural group *L'Estasi di Santa Teresa* (Ecstasy of St. Theresa, 1644–1652) in the Cornaro Chapel in Santa Maria della Vittoria in Rome. Bernini designed this burial chapel in marble, stucco and paint. He shows saint Teresa of Ávila in the highest moment of her religious ecstasy. She seems floating on a bed of clouds. Her clothes have undulating and dissolved forms and distinct movements. At the same time an angel is getting ready to pierce her heart with the long golden dart of divine love. The light of golden rays in bronze falls into the sculpture group through a

special, hidden aperture high up in the vault. This light will clearly emphasize the otherworldly character of the group. We could say that Bernini was a very conscious light designer. See *Bernini, Light design*.

Light type has been described as delicate, difficult to read, feminine, gentle, insubstantial, timid, and unprofessional.

Light waves. Like sound waves, light waves are propagated in straight lines from their source. They can also be reflected, refracted, bent, and absorbed. The velocity of light in air is nearly 300,000 km/s. When light rays (usually parallel) from an object enter the eye, they are refracted in the cornea and lens and pass through the vitreous humour until they strike the retina. When the ambient light level is high, the light rays strike the macula lutea, the fovea, a small area of the retina, which is rich in cones. Cones are the receptors that record colours.

Light-emitting diodes. The picture area in LED-displays may be very large. The resolution is 6,400 pixels per m². The pixels consist of red and green light-emitting diodes with high efficiency, i.e., low power consumption and long life. So far no blue diodes have been developed. Screens with light-emitting diodes are used for advertising. By turning the diodes on and off it is possible to create simple animations, for example, text and simple graphics moving across the screen.

Lighting conditions. Drawers as well as painters and photographers make use of various lighting conditions, light, shadows, and darkness to create perceptions of volume in two-dimensional pictures. A person or an object depicted in hard or soft light will be perceived differently.

Lighting design. See *Light design*.

Lighting designer. See *Light designer*.

Lightness is the experienced intensity of white–black. When the signal to a specific part on a colour display is increased, the lightness of the area is increased compared to the total screen.

Limen, level of consciousness. See *Subliminal messages, Subliminal reception*.

Line. Various lines are often used for decoration to make a more aesthetically pleasing or artistic product. However, lines can also be used to aid communication. See *Lines in visual language*.

Line diagram is a schematic picture. See *Diagrams*.

Line graph. See *Playfair*.

Line length. The length of a line will affect reading speed. The longer the lines the wider the vertical space between them needs to be. Typefaces with small x-heights manage well with less leading than typefaces with large x-heights. Readers tend to dislike both very short and very long lines. Tinker made extensive studies of typography. He worked with characters in sizes of nine to twelve Pica points and recommended ten to twelve words per line. This results in a line length of eight to ten centimetres. There are, however, several other recommendations of line length. Quite often the optimum line length seems to be about $1\frac{1}{2}$ alphabets–42 characters. This is nine to eleven centimetres with optimum character size, ten to twelve points, at a normal reading distance.

A text column may be widened up to 120–130 millimetres to accommodate more text, and still be easy to read for an experienced reader. It is quite clear that too wide lines impair reading. In my opinion the maximum line should not have much more than 60–70 characters. This is except for books intended for highly skilled readers. The optimum line length should be found for each individual purpose and each audience. Costs often force people to use more characters on each line, so that the total number of pages can be reduced. In multi-columnar layouts the narrow columns should have unjustified lines. In a justified text the distances between the words are too long, creating white “rivers” of space in the text columns. See *Interline distance*.

Line numbers. Non-arbitrary numbering systems include the numbering of lines where line endings are meaningful. This might be the case in computer programs, in dictionaries, and in texts used for linguistic analysis. Non-arbitrary numbering systems also include the numbering of paragraphs and the numbering of headed sections.

Line of direction. See Continuity principle.

Line perspectives. In a *line perspective* or *linear perspective* objects are conceived as being placed behind a picture plane onto which straight beams of light (so-called straight lines) are projected. All line perspectives are based on the idea that an object appears to grow larger in size as the distance between it and the observer decreases, and vice versa get smaller in size as the distance between it and the observer increases. A view along a road with identical lampposts or identical trees will produce the

familiar convergence of lines. The lampposts and trees appear to be successively smaller. This phenomenon is sometimes called *diminishing perspective*. The group *Line-based positional perspectives* includes *Central perspective*, *Curvilinear perspective*, *Forced perspective*, *Parallel perspective*, and *Time perspective*.

Line space is the vertical distance from one baseline to another in a text. See *Leading*, *Interline distance*.

Line-based positional perspectives. In a *line perspective* or *linear perspective* objects are conceived as being placed behind a picture plane onto which straight beams of light are projected. All line perspectives are based on the idea that an object appears to grow larger in size as the distance between it and the observer decreases, and vice versa get smaller in size as the distance between it and the observer increases. A view along a road with identical lampposts or identical trees will produce the familiar convergence of lines. The lampposts and trees appear to be successively smaller. This phenomenon is sometimes called *diminishing perspective*. Parallel lines seem to converge or meet at a distant point. Line-based positional perspectives include *Line perspectives*, and *Reversed line perspective*.

Linear perspective. See *Line-based positional perspectives*.

Linear structure. Novels, radio-programs, audiocassettes, records, movies, and TV-programs are examples of linear media. The information is organized with a beginning, a main story, and a resolution.

Lines in graphic design. Various lines are often used for decoration to make a more aesthetically pleasing or artistic product. However, lines can also be used to aid communication.

Horizontal lines can separate sections or paragraphs or hold them together. Horizontal black lines are usually one to four points. When horizontal lines are printed in other colours they may be wider.

When two or more columns are used on a page, vertical lines can be used to clearly separate the text blocks from one another. By tradition vertical lines are thin, usually half a point or one point. See *Rules*.

Lines in visual language. A line may be varied with respect to its starting point, brightness, colour, context, curvature, direction, evenness, grain, length, orientation, and points of change, printing, shape, thickness, value, and terminus. The line is a powerful graphic element. Readers have a tendency to follow a line along its way. As a result lines can be used to direct attention to specific picture elements. The line provides the essential elements for perception of motion in a visual. Since we read from left to right, and from top to bottom in the western cultures most people here will see the upper or left end of a line as its beginning and starting point, and the lower or right end as the ending point or terminus. A line can also be a border between two areas in a visual, and separate, and group picture elements. Since we always perceive graphic elements with respect to the context, the meaning of a simple and single line will vary. A thick and heavy, or bold line is more powerful and strong than a thin line. See *Basic elements, Curved lines, Di-*

agonal lines, Dots in visual language, Horizontal lines, Vertical lines.

Linguistic comprehensibility. The two factors which best designate the linguistic comprehensibility of a text are sentence length and the proportion of long words. An easily comprehensible text is characterized by short sentences, short words, and simple sentence structure. Other variables which affect the comprehensibility of text are the vocabulary's degree of abstraction, the number of syllables in words, the commonness of words used, the choice of subject, the subdivision into paragraphs, the prevalence of clauses, headings and sub-headings, line length, inter-line distance, illustrations, the size of letters, the relevance of the text to the reader, and the page size. See *Readability index*.

Linguistic consultants are responsible for the overall coordination of the linguistic usage and writing style. The linguistic consultants, partly, check the linguistic usage to an agreed standard, and partly, check that the writing style is consistent to an agreed standard. The linguistic consultants may also look at whether the linguistic usage and writing style are used in a uniform way. Terminology experts may review the information and learning materials with respect to the use of consistent terminology. See *Technical writers*.

Linguistic intelligence is defined as our ability to read, write, and communicate with words. Obviously, this ability is highly developed in authors, poets, novelists, copywriters, scriptwriters, orators, political leaders, editors, publicists, journalists, and speechwriters. People in this group are sensitive to patterns.

They are orderly and systematic. They have ability to reason. They like to listen, read, and write.

Linguistic usage. Any language has rules spelling, grammar and punctuation. It is necessary for communication.

Linguistics, is the study of structure and meaning in language.

Linotype is a machine for setting hot type line by line.

Liquid Crystal Display. See *LCD*.

Liquid crystals can be used for instrument displays or for screens. See *LCD*, *FLCD*.

LIS. See *Information science*.

Listening is a language-related activity performed by the listener. Listening is influenced by earlier experiences, language and terminology.

Listening comprehension. Hearing a sentence, a word, or even a syllable requires the listener to integrate the auditory stimuli in temporary sensory memory. The recognition of words in continuous speech is a complex process. Phonemes are recognized even though their pronunciation is affected by neighbouring sounds and by individual accents. We use contextual information in recognizing what we hear.

Listening skills. An active listener concentrate and focus on the verbal message. He or she take time to analyze the structure of the presentation, manage to distinguish between relevant and irrelevant information, and asks the presenter for explanations when needed.

Listening value. Reading value in the written word is comparable to *listening value* in the spoken word.

Lists. Four or more items are best presented as a list. Bullets and numbers are used for items of the first degree. Use a numbered list when the items have to be considered in a particular sequence, and a bullet list when not. Hyphens are used for lists within such a list. Bibliographies are often voluminous and may take up a great deal of space. Since the reader will usually peruse such a list to find only certain entries, they should be made easy to find. See *Indents*.

Lists–bibliographies. References to cited works are usually put in a reference list at the end of a chapter or at the end of a document. One idea is to use hanging indents. See *Hanging indents*.

Lists–subject index. A well-constructed subject index is often an indispensable tool for quickly finding information in books. As is the case with bibliographies, the readers are usually looking only for certain information when they refer to a list of this kind.

Lists–table of contents. The table of contents may have justified or unjustified text. The important thing is that the structure of the content in the document is clearly visible to the reader.

Literacy. Traditionally, the concept of “literacy” was restricted to the ability to *use language to read and write*. Sometimes the ability to listen and speak is added. However, several authors have proposed categories of literacy and the traditional defini-

tion has been extended several times. Today authors write about a large number of different literacies. In my view a number of literacies are assigned to five main categories of literacy: 1) literacy, 2) musicacy, 3) numeracy, 4) visuacy, and 5) elec-tracy/mediacy. A sixth literacy category is called “area specific literacies.” There may be area specific literacies in all five main categories. Se *Area specific literacies, Mediacy, Musicacy, Numeracy, Visuacy*.

Lithography. Originally all lithographs were printed from a flat, lithographic limestone on a flatbed press. The image is drawn on the flat surface of the stone with a greasy crayon, an oily wash, or with India ink. After a chemical treatment the parts of the stone without the image elements are susceptible to water. The printing ink is transferred to the paper from the surface with the image. The Austrian author Alois Senefelder invented lithography in 1798, and it has been used for printing of lithographic art, but also posters, placards, cards, advertisements, etc. As early as in 1858, Jules Chéret (1836-1932) created his first lithographic coloured poster in a characteristic, sweeping style. Ten years later, he returned to France after a seven-year-long stay in London, bringing modern English printing presses with him. Chéret started a mass production of posters on a large scale. Printing up to 10,000 posters per hour was realized, and at a very low cost. Chéret drew his posters directly on lithographic stones. By 1834 specially treated zinc plates began to replace the heavy stones. The use of photomechanical metal plates in the early 1900s made the technique of hand transferring from stones obsolete. In the 1930s the deep-etch

process was introduced. Today graphic artists mainly use the original method.

Live media are personal communications using speech and body language, i.e. ballet, puppet theatre, group communications with social body language, conferences, churches, live music, pantomime, the school and theatre. In verbal presentations, the spoken word can be combined with body language, demonstrations, stills and even brief sequences employing moving images. Live media include personal communication and group communication. Personal communication includes personal body language, and speech. Group communication includes social body language, ballet, pantomime, theatre, live music, conference, church, and school.

LIX. See *Index of readability*.

Logical-mathematical intelligence is our ability to calculate, handle logical thinking, and reason. This is most developed in mathematicians, scientists, engineers, police investigators, lawyers, judges, and accountants. People in this group like abstract thinking and problem solving. They use logical structures and are precise. They enjoy counting and they are organised. Traditionally, most so-called intelligence tests have focused on linguistic and mathematical intelligence. And much schooling around the world concentrates on those two abilities. In accordance with Gardner, this has given us a warped and limited view of our learning potential.

Logo. A logo is a symbol that distinguishes one brand or model from another.

Logography has a set of characters that represent words, morphemes or semantic units. Logographies may have several hundreds, and even thousands of characters.

Logos deals with the intellectual content of the message, and may be judged by real life experiences as well as by logical arguments.

Long-term memory, *LTM*, appears to consist of physical changes in the brain — probably within the sensory and motor association contexts. To some extent this is due to the fact that the former usually constitute an integrated part of larger mental networks, whereas the latter more often have a fragmentary, non-connected status. Long-term memory comprises schemata, organized networks of related knowledge that permit the human being to represent reality and to act upon this cognitive representation. LTM is what most people mean when they refer to “memory.” The long-term memory has *episodic memories* of specific things we have done, seen, heard, felt, tasted, and so on. They are tied to specific contexts. The long-term memory sets the rules for the selection filter, so that the filter makes selections related to previous experience. Normally, we are unable to access all information stored in our long-term memory. See *Memory*.

Low quality images. At an oral presentation it may be better not to use any visuals at all than having to use low quality images. Poorly executed and poorly presented images will influence the understandings of the whole oral presentation. Simple pictures are “immediate.” They speak to us holistically and emo-

tionally. When readers get the “wrong impression” it may be very hard to change this later on.

Lower case is the un-capitalized “small” letters of the alphabet (a, b, c etc.).

LTM. See *Long-term memory*.

Lumière. The two French brothers Auguste Marie Louis Nicolas Lumière (1862–1954), and Louis Jean Lumière (1864–1948), were the earliest actual *filmmakers* in history. The brothers worked in their fathers photographic firm. When their father retired in 1892 they began to create moving pictures. They showed their first ten motion pictures in Paris in 1895. Each film was 17 meters long and lasted for approximately 50 seconds.

Luminance is a photometric measure of the amount of light emitted by a surface (lumen/steradian/sq.m). Different parts in graphic figures should have about the same luminance. The true differences between areas can be hard to see when shaded differently.

M

Magenta is the particular red-purple colour used in process printing with four colours.

Magnetic field board. An electronic magnetic field board consists of small hexagons containing a black magnetic material, like iron filings. Close-up the board looks like a honeycomb. By using a magnetic head, a “page” with text or images can be built up. The board is “erased” by changing the magnetic field. It is also possible to write directly on the board with either a magnetic pen or with markers of different colours.

Main goal in information and instruction design should always be *clarity of communication*. Thus any graphic message should be legible, readable, and well worth reading for the intended audience, and any audio message should be audible, distinct, and well worth listening to for the intended audience. The presentations might also be exciting, aesthetically pleasing and visually rewarding.

Main message refer to the most important part of the message. Excessive detail in image and text may distract from the main message.

Main types of verbal and visual representations are based on how the verbal information is presented to the receivers: 1) We read the printed words in lexi-visual representations, such as messages printed in a book, or messages displayed on a computer screen. 2) We listen to the spoken words in audio-visual representations, such as oral presentations with slides or overhead transparencies, and in television programmes. 3) We read

printed words and listen to spoken words in a combination of lexi-visual and audio-visual representations in multi-visual representations, such as interactive multimedia systems.

Manuals and instructions have been preserved since the 15th century.

Manutius. The Italian humanist *Aldus Pius Manutius* (1449–1515) founded the Aldine Press in Venice and became the most famous printer and publisher of his own time. He commissioned the punch cutter *Francesco Griffo* (1450–1518) to cut a compact, narrow and slanted typeface. This “Italic typeface style” allowed for more economical use of space, and became known as Aldus Roman type. They designed a scheme of book design for inexpensive small size books, in octavo book format. Manutius published the beautifully illustrated book *Hypnerotomachia Poliphili* (1499) with 170 refined woodcut illustrations nicely matched to the font and in an elegant page layout.

Maps is a group of schematic pictures. Maps are heavily reduced flat images of the surface of the earth. A map enables the user to see a generally complete representation of the world at one time. Mapmaking, or cartography, attempts to reproduce portions of the earth with a minimum of distortion.

Marey. The French photographer Étienne-Jules Marey (1830–1904) was a pioneer in photography and in the history of cinema. He developed animated photography and he was able to catch several phases of a movement in one photo. In 1890 he published the richly illustrated book *Le Vol des Oiseaux* (The Flight of Birds). In the book he used diagrams, drawings, and photographs.

Margins. The text-face on a page is surrounded by margins: a header (or top margin) and footer (or bottom margin), an inner and an outer (or outside) margin. They provide space for comments, headings, illustrations, page numbers and personal notes. Margins also provide space to hold a printed document while reading it.

Margins size. Readers expect margins in books to occupy 40–50% of the space on the page, although this amount can be reduced in professional or scholarly texts. Headings, margins and “empty” space can be used to aid communication when used in a consistent way. Guidelines for margins vary a lot, but a general guideline may be to make all margins one inch on a standard 8 1/2" x 11" page. In electronic documents margins may be much smaller.

Marks. In magazines and other periodical publications, it is sometimes necessary to use *continuation marks* like arrows or triangles and a reference to page number, and *terminal marks* after the last paragraph. A terminal mark is often a circle or a square, filled or unfilled. Sometimes the terminal mark is the initials or the signature of the writer.

Mass design. I use the term “mass design” as an umbrella term in order to bring related mass design areas together. This group could also be labelled “entertainment design.” Mass design includes aspects from communication studies, mass-communication, media studies, photography, and journalism. Main intentions with these “messages” are to provide entertainment, and news to large audiences. The individual information interpreters might be seen as “relaxers.”

Mass design objectives. In mass design the main intentions are to provide news, views, and entertainment. The interpreter/s may develop views, relaxation, emotions, and awareness. In mass design it may be an advantage to use verbs like *feel, laugh, look, read, and relax*. One example of a performance objective for entertainment on television may be: “80% of the viewers should have fun and laugh at the jokes.”

Mass-communication, developed as an academic field in the USA during the 50s and 60s. It evolved from the intensive research on audio-visual instruction and audience research during World War II. In mass-communication the main focus was on the senders, who wanted to reach out with their specific messages to large groups of receivers. These messages were mainly intended to provide entertainment, information and news, and to some extent also advertising and propaganda. The receivers could be newspaper readers, radio listeners, and television viewers.

Mass-media societies. In the industrialized part of the world we are bombarded with information via the media, at home, in school, on the job, and in the society in general. It is rather hard to avoid information and just as hard to obtain the “right” information, the information that we need at the right time. Audio, text, and visuals compete for our attention. It is possible that we miss the information in which we are really interested. In addition to radio, TV, books, newspapers, and magazines, vast amounts of information are distributed in the form of letters, advertising throwaways, posters, placards, stencils, photocopies and photographs. See *Information age*.

Matrices is a group of schematic pictures that show mathematical quantities consisting of rectangular arrays of numbers. This group includes: 1) Four-field matrices. 2) Multiple field matrices. 3) Complex matrices.

Maximized learning. Results from several experiments show that when the contents are the same in visual, audio, and print channels, learning is maximized.

McLuhan. See *Medium and message*.

MD. See *Message design*.

Measurement pictures are representations of various measurements in, e.g., medicine. Ultra sonograms are examples of pictures employed for identifying differences in the density of body tissues. The brain's activity can be visualized and measured with a positron camera. Measurement of thermal radiation is another example. Satellites with multispectral scanners continuously record and transmit digital TV images of the Earth. These images are analyzed and used for many different purposes in meteorology, geology, agriculture, and forestry. The interpretation of satellite pictures is a widespread activity. Photographic pictures are also used for a wide range of military applications.

Mechanical typesetting. See *Hot type*.

Media. Each medium has unique aesthetics, codes and conventions. People have to learn how media are made and how they function. Each person bring her or his own experiences that affect the understanding of the representations. Different media are capable of representing reality with varying facility owing to

differences in their structure, the kind of representation involved, and the content in each specific case. See *Media and communication*, *Media consumption*, *Media development*, *Media evolution charts*, *Media education*, *Media for advertising*, *Media for propaganda*, *Media groups*, *Media industry mapping*, *Media literacy*, *Media markets*, *Media properties*, *Media selection*, *Media trends*, *Medium*, *Medium and message*.

Media and communication is a wide area of research. At universities in Sweden media and communication studies take an interest in research on mediated communication, in contrast to research on personal communication that is common in many other countries. See *mediated communication*.

Media consumption. In the industrialized, cultural sphere, we are living in mass-media societies. Every day we are bombarded with information via the media, at home, in school, on the job, and in the society in general. It is rather hard to avoid information and just as hard to obtain the “right” information, the information that we need at the right time. Audio, text, and visuals compete for our attention. It is possible that we miss the information in which we are really interested. In addition to radio, TV, books, newspapers, and magazines, vast amounts of information are distributed in the form of letters, advertising throwaways, posters, placards, stencils, photocopies and photographs.

Media development. For many years the media situation was very stable, only expanding a little each year. In the 1950s we had live media, sound media, film media, broadcast media, models and exhibitions, graphic media and telecommunications

media. In the 1970s video developed into a competitive medium. At the same time the classical “borders” between the media groups began to dissolve. In the 1980s several new technologies, most based on computers, and completely new media began developing. See *Medium*.

Media evolution charts. The development of media can be shown in graphical media evolution charts. See *Media development*.

Media education. Key concepts of media education include questions like: 1) Who is the sender? 2) Who is the receiver? 3) What type of message is it? 4) What type of media are used? 5) How is the message produced? 6) What kinds of technologies are available?

Media for advertising. It seems that all media can be used for advertising. The elements of an advertising message are the words, the pictures, the music, the sounds, the characters, the setting, and the action itself. The structure is the way the elements are combined to create an effect of a coherent message. In order to influence others, the senders must exchange information, accurately transmit their messages and intentions, and identify and understand the habits of the intended receivers. Advertising pictures speak directly to our emotional life in a direct way, without any deeper cognitive involvement. See *Advertising*.

Media for propaganda. In the Roman Empire the ruling groups used architecture, art, literature, and music in a systematic way to demonstrate the imperial power and its sovereignty. A number of impressive buildings around the world, the great

equestrian monuments of Donatello, and Andrea del Verrocchio and some monumental paintings by Peter Paul Rubens were used for propaganda. Martin Luther used caricatures, cartoons and leaflets in the fight against Catholicism. Propaganda pictures and propaganda texts are one-sided and they reinforce our prejudices and past perceptions. Propaganda pictures speak directly to our emotional life in a direct way, without any deeper cognitive involvement. See *Propaganda*.

Media groups. The main groups of media are: 1) Live media, 2) Sound media 3) Film media 4) Broadcast media 5) Video media 6) Models and exhibitions 7) Graphical media 8) Telecommunications media, and 9) Computer media.

Media industry mapping. Several attempts have been made to make “maps” or “models” of the media industry. These maps might be useful as tools for strategic planning for the information business. However, it is not easy, or even possible, to make one single map that covers all aspects of the media industry. We have to work with a set of different maps at the same time. Such maps have been produced according to criteria such as growth of the information business, media evolution, needs of the users, number of receivers, technical development, and time of delivery.

Media literacy is the ability to access, analyze, create, evaluate, experience, and produce messages in a wide variety of media forms. A media literate person can comprehend, read, recognize, and question ideas and information, whether conveyed through printed media or other media formats. The main principle of media literacy is that media represent actual events.

Journalists select which stories to tell, what to tell, and how to tell them. There are always one or more persons with their subjective views behind all representations. See *Medium*.

Media markets. We can hardly define one single media market. There are a number of specialized media markets or market segments. These are dependent on factors such as different needs, geographical and political situations, hardware, languages, software, trade and customs regulations, the information economy, and technology trends.

Media properties. A distinction is often made between private media, group media, and mass media. Each medium has its own particular advantages and disadvantages. Audio, text, and visuals compete for our attention. The selection of a suitable medium is important when an informative material is to be produced.

Media selection. It is always important to select the most suitable medium to carry the intended message. Therefore the information designer will have to: 1) Select the most suitable medium for the message. 2) Produce synopsis for text, pictures, and sound. 3) Adopt the graphic design to the medium. As far as the choice of medium is concerned, regard must be paid to the suitability of various media in every individual case. To be successful the sender has to know the medium and its unique possibilities. Advantages should be utilized, and disadvantages should be avoided. See *Medium*.

Media trends. The following general trends are discernible for new technology and new media: 1) A shift from goods to services. 2) A shift towards increased segmentation. 3) A shift to-

wards greater flexibility. 4) A new 'distribution of roles', and tradition areas of competence will be broken up and superseded by new ones. 5) A shift towards new production systems. 6) A shift towards new channels for marketing. 7) Increased competition for the individual consumer's time and money. 8) The borderlines between different groups of media will gradually disappear. 9) Many new media and new technologies will be developed by 'hybridisation'. 10) An international, integrated digital telecommunications system will replace today's different systems. 11) A common world standard for television will be developed. 12) Increased copyright problems.

Mediaan system system is a system for measuring size in typography. It is used in France. Here 12 points = .1649 inch = 4.205 mm. 1 pt = .3504 mm (72.5 pts/inch). See *Size of type*.

Mediacy. The two terms *electracy* and *mediacy* seem to represent quite similar concepts, both include the ability to understand and work with digital media. *Electracy* describes the skills necessary to exploit the full communicative potential of new electronic media. *Mediacy* is a facility in interacting and working with media. Electracy/mediacy are to digital media what literacy is to print media. 21st century literacy, computer literacy, digital literacy, hypertext literacy, multiliteracy, multimedia literacy, multimodal literacy, new media literacy, screen literacy, and transliteracy belong in this category

Mediated communication comprises the study of the communication processes, including the technical production of media. Some years ago the main focus was on the senders, who wanted to reach out with their messages to large groups of re-

ceivers in mass-communication. These messages were mainly intended to provide entertainment, information and news, and to some extent also advertising and propaganda. Today it is more common in media and communication studies to focus on the individual receivers, their individual interpretations of the varying messages, and the constructions of meaning made by the receivers. See *Media and communication, Medium*.

Mediated messages refer to messages that are distributed via media. Mediated communication comprises the study of the communication processes, including the technical production of media. It is common to focus on the individual receivers, their individual interpretations of the varying messages, and the constructions of meaning made by the receivers. See *Medium*.

Medium is an aid used in the transfer of information from a sender to a receiver. Each medium has its own particular advantages and disadvantages. Audio, text, and visuals compete for our attention. It is always important to select the most suitable medium to carry the intended message. Different media are able to represent reality with a varying degree of facility owing to differences in their structure, the kind of representation involved, and the content in each specific case. Different media are related to one another in regard to their level of structural complexity. The main groups of media are broadcast media, computer media, film media, graphical media, live media, models and exhibitions, sound media, telecommunications media, and video media. See *Media, Media and communication, Media consumption, Media development, Media evolution charts, Media education, Media for advertising, Media for propaganda, Media groups, Media industry mapping, Media liter-*

acy, Media markets, Media properties, Media selection, Media trends, Medium and message.

Medium and message. In the 1960s professor Marshall McLuhan coined the expression: “The medium is the message”. This expression has given rise to considerable confusion. During the 1980s it was often stated: “The message is the medium”. Technology is the servant, and the message, the idea, is the master. However, the medium is not the message. A medium is an *aid* used in the transfer of information from a sender to a receiver. The term aid is used here as a collective designation for the channel, or information carrier, and the processor/equipment required for encoding and decoding of the information.

Medulla oblongata in the brain stem, the lower region of the brain, regulates autonomic functions, such as control of movements and breathing.

Memory. There are many models seeking to explain the function of our memories. Information is processed and remembered in chunks that are organized hierarchically. See *Declarative memory, Episodic memories, Explicit memory, Long-term memory, Procedural memory, Short-term memory, Semantic memories, Sensory memory, Visual memory.*

Memory and message design. There is a close relationship between guidelines aimed at providing simplicity and guidelines aimed at facilitating perception, processing and memory. Simplicity in a message will result in easier and more effective perception, processing and memory of that message.

Memory for pictures is superior to memory for words. This is called the “pictorial superiority effect.” Visual memory is very fast. Emotionally charged pictures may improve motivation for reading and thus improve the memory. Memory for a picture-word combination is superior to memory for words alone or memory for pictures alone. Learners are most able to build connections between verbal and visual representations when text and illustrations are actively held in memory at the same time. This can happen when text and illustrations are presented in close connection, for example on the same page in a book, or when learners have sufficient experience to generate their own mental images as they read the text. Therefore pictures should be put as close to the relevant text as possible. See *Dual-coding memory model*.

Memory for text is better when content is meaningful. We best remember what we read at the beginning and at the end of a reading session. The optimum time for learning from reading seems to be 20–40 minutes, and then it is time for a pause. We will forget most of what we learn if we do not rehearse the material. After finishing reading, it is time for the first rehearsal, reading keywords and notes. It is a good idea to repeat this after a day, after a week, and after a month. Retrieval from verbal memory is a serial integration and sequential processing of auditory-motor perception systems. See *Dual-coding memory model*.

Memory for words. See *Dual-coding memory model*.

Memory models. A number of models, or theories, describe the transfer of information through memory. One way of view-

ing memory functions is based on information processing in steps, the “*information processing theory.*” Another way is the “*dual-coding theory.*” In accordance with the “*cue information theory,*” information that is shared between channels facilitates learning. Cues that occur simultaneously in auditory and visual channels are likely to be better recalled than those presented in one channel only. See *Dual-coding memory model, Memory.*

Mental health literacy is knowledge and beliefs about mental disorders that aid their recognition, management or prevention. Members of the public need to have some knowledge to allow them to recognise prevent and seek early help for mental disorders.

Mental images. See *Dual-coding memory model.*

Mental literacy is a metaphor for the use of the brain as a computer.

Mental model, an explanation of someone’s thought process about how things work in the real world.

Mental processing and message design. The producer of information and learning materials can facilitate communication, and the various learning processes of the receivers. Complicated language, in both texts and pictures, will impair the understanding of any intended message. Thus, text and pictures for information should always be designed so that they are easy to read. Any graphical message should be legible, readable, and also well worth reading for the intended audience. Any aural message should be audible, distinct, and also well worth listening to for the intended audience.

Message. Several definitions may be summarized as: “A message is information content conveyed from a sender to a receiver in a single context on one occasion.” In principle the term message is valid for all media. There are different types of messages. Different combinations of linguistic expressions are usually employed in mass-communications. For example, a newspaper generally uses both the printed word and different kinds of pictures. A television programme employs words, images and sounds, such as music. Based on traditional, directional and process-oriented communication models we may study the concept “message” from several views, such as sender, representation and receiver.

Message access. In order to provide *external access* to information materials the information designer should design information materials to fit main systems for storage, use international standards, such as standard page sizes, and consider aspects of information security.

Message attention is needed. In directing attention we seek a balance between novelty and familiarity, between complexity and simplicity, between uncertainty and certainty. Familiarity in excess produces boredom, while novelty in excess produces anxiety. Change and novelty should direct attention to the most relevant ideas in a message rather than to marginal or superficial content.

Message clarity is determined by legibility, the technical design of texts and pictures. Information sets should be as clear, simple, unambiguous and transparent as possible. Avoid unusual typefaces, as well as fonts that are too small or too large.

Adapt typeface and font size to meet the limitations of the medium and the technical production. A message has good legibility if it is easy to read, from the viewpoint that the reader should easily be able to see and distinguish all different parts.

Message content, context, format and structure influence the viewer's ability to perceive it. Learning is maximized when contents are the same in different channels. Information presented in pictures is encoded twice, once as a picture and once as a verbal label for the picture. The redundancy in memory that results from this "dual coding" means that information can be retrieved either from the pictorial or from the verbal memory. See *Dual-coding memory model*.

Message context. The context in which a message is presented has a major impact on the way that the message is perceived. For example, the context may consist of text, speech, music, sound effects, or visuals. Message context will influence interpretation and can convey a "pre-understanding" of content. See *Context perspective, Pre-understanding*.

Message credibility is important for the source as well as for the receiver. Receivers believe in a high credibility message with good structure, convincing arguments, proper references, and relevant examples. It must be possible to understand the message and to be able to believe that the information is honest and correct. High credibility sources exert a more persuasive influence than low credibility sources.

Message design, MD, is an interdisciplinary field of knowledge. It encompasses influences and facts from more than fifty

established disciplines and areas of research. The main areas of research may be divided into six groups with “base disciplines.”

- *Language disciplines* such as drama, graphic design, linguistics, rhetoric, semiotics, verbal languages, visual languages and visual literacy.
- *Art and aesthetic disciplines* such as aesthetics, computer graphics, film and cinema, iconography, iconology, illustration, and photography.
- *Information disciplines* such as computer science, information processing, and library and information science.
- *Communication disciplines* such as communication theory, education technology, information design, information technology, information theory, instructional design, instructional message design, instructional technology, journalism, media studies, persuasive design, planned communication, television and video.
- *Behavioural and cognitive disciplines* such as cognitive science, didactics, information ergonomics, pedagogy, psychology, and parts of sociology.
- *Business and media production technology disciplines* such as business economics and management, information economics, information management, law, technologies for production and distribution of media.

This “message design model” is a theoretical model showing that different knowledge areas influence and contribute to message design. Please note that the ovals in the illustration representing the various groups of disciplines are not meant to be sharp and distinct. The borders between the groups are rather blurred, unclear, and indistinct. Furthermore, the model is not

intended to show any exact relationships between the different groups of the “base disciplines.” See *Design science*.

Message design family. A group of design disciplines all deal with the design of messages. The main components in message design are *words, visuals and forms*. These main components may be used in many different ways to produce, transmit and interpret messages of various kinds in different communication situations. Depending on the different objectives of the messages we can see different “message design genera.” These groups are graphic design, information design, instruction design, mass design, and persuasion design. All message design disciplines have got a theoretical as well as a practical component and message designers need to have theoretical knowledge as well as practical skills. In order to perform sound reflections and make a qualified reflection regarding theory and practice, we need concepts both to structure our thoughts, and to describe them verbally.

Message design genera are graphic design, information design, instruction design, mass design, and persuasion design. See *Message design family*.

Message design model is a theoretical model showing that different disciplines influence and contribute to the area of message design. See *Message design*.

Message design objectives are important to define always keeping the intended receivers in mind. See *Graphic design objectives, Information design objectives, Instruction design objectives, Mass design objectives, Persuasion design objectives*.

Message design Research. See *Research*.

Message design principles. A number of authors have offered design principles in different areas, such as data graphics, general design, graphic design, message design, instructional design, instructional message design, information design, and persuasion design. Some principles are general, while others are specific. However, all message design principles should contribute to the design of effective and efficient messages. See *Administrative principles, Aesthetic principles, Cognitive principles, Functional principles, Guidelines, Information design principles, Message design processes, Principles*.

Message design processes and sub-processes are influenced by message design principles, and are performed with message design tools suitable for the type of representation that is selected during an early phase of the work. These principles can be seen as a set of guidelines for design of verbal and visual messages and information materials. Models for design processes include cognitive as well as practical activities and aspects. My own model include the following four process activities: 1) Analysis and synopsis, 2) Production of draft, 3) Production of script, and 4) Production of original and master. Each activity includes a design sub-process, activity documentation, and a review process.

Message design tools. The design process and sub-processes are performed with message design tools that are suitable for the type of representation that is selected during an early phase of the work. Main message design tools include text (printed and spoken), symbols, pictures (drawings and photographs),

typography and layout, sound and sound effects. These tools have different properties that offer and restrict the foundations for communication. See *Message design processes*.

Message evaluation. The receiver's evaluation of the message will affect her or his evaluation of the source.

Message execution. Several authors have pointed out “form follows function.” Thus the content of the message is more important than the actual execution of the message. Therefore, we should always begin by defining what any message is supposed to show. What is the problem we want to solve? The information in each message will have to be structured and adapted to the needs of the target group, the intended readers or listeners.

Message legibility. Legibility is determined by the technical design of the text and the pictures, that is, their clarity. Avoid unusual typefaces, as well as typefaces that are too small or too large. Typeface and font size must be adapted partly to the medium and partly to the choice of technical production.

Message literacy is the ability to access, analyze, evaluate, interpret, create, produce and distribute messages that are conveyed by words, visuals, forms, music, and numeric data etcetera. Message literacy helps the intended receivers to read, recognize, comprehend, experience, and understand message contents, whether conveyed to them through print media or other media formats.

Message memory. See *Memory*.

Message objectives should be defined while always keeping the intended receivers in mind. See *graphic design objectives*,

persuasion design objectives, mass design objectives, information design objectives and instruction design objectives for examples of objectives.

Message objectives diagram is a rhomb, divided in four parts of equal size. Each part represents different sets of objectives and receiver activities that may be noted as a cognitive state of mood. The first part, learning and subsequent knowledge is located in the top corner. Knowledge may develop into insight and wisdom. The second part is the right corner. It represents experiencing feelings such as beliefs, delight, desire or willingness to buy something, distress, dread, eagerness, excitement, fear, fun, grief, happiness, mourning, opinions, pleasure, prejudices, romance, satisfaction, sorrow, and tension. The third part, at the bottom corner represents relaxation, such as ease, rest, and slackening. The fourth part, at the left corner represents understanding, including awareness, consciousness, and understanding of facts. See *Message triangle*.

Message purpose. The purpose of an intended message may be advertising of a product or a service, providing a business proposal; providing education, entertainment, information, instruction, learning, training, establishing a change of behaviour, making a decision, performing an action of any kind, or any combination of these and many other examples.

Message receiver. The receiver's evaluation of the message will affect her or his evaluation of the source.

Message response is sometimes easy to predict. This predictability is often heavily exploited in movies, television, and theatre. However, often people respond differently to the same

message. Individuals differ in their ability, motivation, and readiness to respond to a message. Reinforcement is helpful in establishing response. In learning, active participation is better than passive participation. Meaningful responses are easier to learn than meaningless responses.

Message rhomb. See *Message objectives diagram*.

Message simplicity. Simplicity in a message will result in easier and more efficient perception, processing and memory of that message.

Message structure. A great deal of perceptual organization occurs pre-attentively, not under cognitive control. The way a message is organized, therefore, will have an important effect on the way the perceptual system structures what it detects and, in ways that the perceiver will not be aware of, on how that information is interpreted.

Message triangle. In an attempt to compare different kinds of mediated products I have used a triangular diagram, based on perceived experiences of various kinds of media products. The corners in the triangle represent learning and new knowledge, experiencing feelings, and understanding of facts. This *message triangle* was further developed into a rhomb in order to better cope with various message objectives in different media. See *Message objectives diagrams*.

Meta-information can be abstracts, different classification systems, index tables, information about the author of a book, keywords, etc.

Metal type. See *Hot type*.

Metaphorical pictures is a group of schematic pictures that are used for something that has a similarity with the actual image contents. Some examples are: 1) Staircase leading to a target. 2) Pieces in a jigsaw puzzle. 3) Concentric circles around a centre. 4) Circulations. 5) Spirals showing circular continuity.

Metroglyph chart is a schematic picture. See *Diagrams*.

Mezzotint. In mezzotint the entire surface of the copperplate is first covered with hundreds of small pricks. These are bur-nished and scraped to create light areas. Mezzotint was in-vented in the 17th century and was used extensively until the early 19th century. It was the only method by which the many nuances in oil paintings could be reproduced. Graphic artists mainly use this method as a fine arts technique.

Midbrain in the brain stem, the lower region of the brain, is involved with sensory and motor integration.

Middle Ages. “What writing is to the reader, pictures are to those who cannot read,” stated Pope Gregory the Great (540–604). Already by the Middle Ages, a wide spectrum of image types was already used for teaching and training. The pictures ranged from realistic drawings to abstract diagrams. Pictures were used for the identification of important medical herbs, for instruction on how to load and use a cannon, how to swim, how to fight with a sword, how to construct a building, and for train-ing the art of angling.

Miedinger. The Swiss typeface designer *Max Miedinger* (1910–1980) designed the sans-serif typeface *Neue Haas Gro-*

tesk in Zürich 1957. It was renamed *Helvetica* in 1960, and was immediately a success. See *Helvetica*.

Military perspective is a level perspective. It is higher than the *Gentleman's perspective* and used in several historical paintings of troops and battles. This perspective is perfect to see the different groups of soldiers on the battlefield.

Minard. The French engineer Charles-Joseph Minard (1781–1870) was a pioneer in diagram design. After his retirement Minard designed more than fifty graphic tables and thematic maps with statistical information showing changes and movements of various kinds, in space, time and volume. He is known for his inventions in the field of information graphics. Minard designed a map using pie charts to represent the cattle sent from all around France for consumption in Paris (1858), and a unique *flow map* of Napoleon's disastrous Russian campaign 1812–1813 (1861). Here Minard combined statistical data with a time-line treatment in a single two-dimensional image.

Mirror images. See *Image morphology*.

Mixed modality. Children with *mixed modality strength* learn from visual, auditory, as well as kinaesthetic and tactile stimuli. See *Modality*.

Modal. Relating to form or mode as opposed to substance.

Modality. The word “modality” is used as a term for concepts in quite different areas such as cognitive theory, education, educational psychology, learning, linguistics, medicine, multimedia, music, semiotics, sociology, theology, transportation, and visual analysis. See *Auditory modality*, *Contradictory relationship*,

Irrelevant relationship, Kinaesthetic modality, Mixed modality, Modality in educational psychology, Modality in semiotics, Modality in visual analysis, Modality principle, Multimodality, Redundant relationship, Relevant relationship, Visual modality.

Modality in educational psychology. In “educational psychology” modality refer to inner, mental activities and experiences. It is mainly a *reception* perspective. People may have auditory, kinaesthetic (or tactile), visual modality, or a combination of these modalities. In the USA, it has been found that 30% of elementary school children have visual modality, 25% have auditory modality, and 15% have kinaesthetic modality. The remaining 30% have a mixed modality.

Modality in semiotics. In semiotics modality refers to the channel or mode by which signs and representations are transmitted.

Modality in visual analysis. In visual analysis modality means how real a representation should be taken to be.

Modality principle. According to the “modality principle” multimedia materials that present both verbal and graphical information should present the verbal information in an auditory format and not as written text.

Models and exhibitions is the name of a media group. In contrast to other groups this group is multidimensional. The depth dimension makes it possible to exhibit models and real objects with a spatial relationship to each other and to the public. The use of acoustic media provides some idea of the chron-

ology. Film and video media also contribute movement, distinct processes and courses of events. Lighting, texture, smells and tastes can also be utilised. Many exhibitions offer visitors opportunities to perform their own activities.

Moderate weight type has been regarded as professional.

Modern textbooks often have many different types of pictures such as black and white photos, caricatures, cartoons, collages, colour photos, diagrams, graphs, realistic drawings, and maps. But how are the pictures used? A poll of teachers in Stockholm showed that they often consider the pictures in textbooks as “good,” but that many pictures quite simply are “unnecessary.” Less than half of the colour photos, and drawn illustrations in the textbooks were interpreted as relevant to the texts. At the same time we know that colour pictures are very expensive to buy and to print, and they force up the price of textbooks. And often colour adds no pedagogical value to a picture.

Modern type is a typeface with thin, flat serifs.

Moiré is an undesirable pattern in a picture which occurs by re-screening halftone copy.

Mono-spaced type. In mono-spaced type all the letters have the same amount of space. The letter “i” takes the same space as the letter “m.” See *Proportionally spaced type*.

Monotype is a machine for setting hot type letter by letter.

Morison. The British typographer *Stanley Morison* (1889–1967) was one of the most influential type designers of the 20th

century. Commissioned by the British newspaper *The Times* he and *Victor Lardent* (1905–1968) designed the serif typeface *Times New Roman* (1932). See *Times New Roman*.

Morphemes are the smallest grammatical units with meaning in a language. Morphemes are combined to form syntagms, i.e., words, phrases, sentences, and complete texts. Spoken and written languages are formed from a limited number of phonemes (usually 20–40). These phonemes can be inter-combined in a limited number of ways. See *Phonemes, Syntagms*.

Morphology 1. Morphology is the study of form and structure of anything.

Morphology 2. In biology and life sciences morphology is the study of form and structure of organisms and their parts.

Morphology 3. In linguistics morphology is the study of words in a language, how words are formed, changed, and combined.

Morris. The English artist, furniture designer, illustrator, philosopher, poet, textile designer, and writer *William Morris* (1834–1896) was a pioneer in graphic design, and type design. He realized the importance of a well-functioning graphical form that can clarify, emphasize, and explain what is important in a graphical message.

Motion and rhythm. Several types of content benefit from being shown in media with moving pictures such as film, video and television. The best way to illustrate motion in a still picture is to depict a natural movement in a clear contrast to a static situation. In a still picture the impression of motion can be enhanced with graphic motion symbols such as speed lines that

are common in comic strips. The meaning of these symbols has to be learned, and in fact are usually soon learned even by young children.

Motion designer. The sculptor Bernini solved complicated spatial relationships and various motion problems with great imagination and great skill. He transformed immobility and certainty into movement and ambiguity. Already at a young age he demonstrated this with some stunning works. See *Bernini*.

Movable type. The world's first known movable type printing press technology using ceramic materials was invented in China around 1040. The first movable-type printing press technology using metal was developed in Korea in 1234. Both systems required enormous amounts of labour in the production of large numbers of individual characters, and then production of complete solid ceramic tablets and metal tablets respectively for each individual page. In the middle of the 15th century Johann Gutenberg invented the first European printing press, and he independently developed a movable type system. See *Johann Gutenberg, Technology for words*.

Movement dimension. See *Pictorial dimensions*.

Moving pictures in movies and television can trigger associations and easily influence emotions and attitudes. Moving pictures can be affective and provide readers with entertainment and reinforce an experience both positively and negatively. In advertising and television, pictures may carry subliminal messages. Ads for liquor or cigarettes, for example, sometimes use sexual symbols.

Mulhall. The Irish journalist Michael George Mulhall (1836–1900) was a pioneer in statistical diagram design. He introduced simplified images, called *pictograms*. In a chart or a map the varying sizes of the pictograms represent data. Different sized silhouette images of a cow, for example, can represent meat production in different countries. Silhouette images of ships can illustrate volumes of transported goods. The reader should compare the size of these diverse areas.

Multi-dimensional. Like mathematics information design principles are not tied to the unique features of a particular language, nor are they tied to a particular culture. Information design is a worldwide consideration and not related to any particular language or culture.

Multi-disciplinary. Information design is a new discipline, but it is not a new area of knowledge. See *Information design genus*.

Multi-view perspectives. In multi-view perspectives different views appear at the same time in a picture. Pictures made by young children, like many of the paintings from ancient Egypt, India, and pre-Renaissance European art depict objects independently from their surroundings. The pictures show objects as they are known to be rather than as they are seen to be. At the end of the 19th century Paul Cézanne flattened the conventional Renaissance central perspective. Inspired by Pablo Picasso, the cubists broke off completely with the traditional conception of space, and modern art became totally liberated from the time-honoured laws of perspective. Today modern art, oriental art, and illustrations in children's books often use multi-

perspectives or multi-view perspectives. See *Other positional perspectives*.

Multilevel pie chart is a schematic picture. See *Pie charts*.

Multiliteracy is the ability to understand and use literacy and literate practices with a range of texts and technologies (including computers, cell phones, the Internet, and social networking sites.)

Multimedia referred originally to the use of several different media at the same time. An example is a verbal presentation where the presenter uses slides and audiotape. Today this concept refers to the use of several representations on one or more computer screens, controlled by a computer. It may be still or motion video, text, graphics, audio, and animation. The information is usually stored with digital technology on digital-based platforms.

Multimedia learning is a kind of E-learning. See *E-learning*.

Multimedia literacy, *new media literacy*, *screen literacy*, is the ability to cope with the numerous media in use today.

Multimodal literacy is the ability to shift modes from open to closed networks.

Multimodality. “Multimodal messages” combine various modes of representation and the interplay between these. Thus multimodality attend to the full range of communicational forms people use, such as body language, gaze, gesture, image, posture, sound, speech, and so on, and the relationships between them.

Multiple bar is a schematic picture. See *Bar charts*

Multiple field matrixe are a kind of matrix. See *Matrices*.

Multiple frequency polygon is a schematic picture. See *Graphs*.

Multiple histogram is a schematic picture. See *Graphs*.

Multiple line graph is a schematic picture. See *Graphs*.

Multivision, *Video Wall* is a display system where many television-receivers (for example 16, 24, or 30) are put close together forming a check pattern. All screens can show the same image, different parts of the same image, or different images in varying configurations. Multivision is used at, for example, shows, exhibitions, and sometimes in department stores.

Munsell Colour System (MCS) was introduced in 1905 and has been modified several times. The system consists of fixed arrays of samples which vary, in hue, lightness (here called value), and saturation (here called chroma). The value scale ranges from white to black with nine steps of grey. Forty equal steps in a circle represent hue. The value and the hue are related to each other by a maximum of sixteen "saturation steps." See *Natural Colour System*.

Music is a sophisticated language with its own logic and syntax. Music reading and writing skills are quite different from language reading and writing skills.

Musicacy, *musical literacy*, is the ability to understand and work with music. It incorporates the ability to read music and understand how to make the notes on a page audible (through

singing or playing an instrument). To be musically literate, a person has to be comfortable with musical expressions.

Musical intelligence is the ability to compose songs, sing, and play instruments. People with musical intelligence are sensitive to pitch, rhythm, timbre, emotional power of music, and organisation of music. This is obviously highly developed in composers, conductors, performers, musical audiences, recording engineers, musical instruments makers, piano tuners, and also in cultures without traditional written language.

Musical literacy. See *Musicacy*.

Muybridge. The English photographer Eadweard Muybridge (1830 – 1904) made the first projected film, after 1877 and before 1880. In the 1880s Muybridge produced over 100,000 images of animals and humans in motion at the University of Pennsylvania in Philadelphia.

Myopia, or *nearsightedness*, means that the image of a distant object is formed before the retinal plane. The axial length of the eye is too long for the lens. Close objects, however, are properly imaged on the retinal plane. In the opposite case, the axial length of the eye is too short for the lens. Now distant objects are properly imaged on the retinal plane. Close objects, however, are formed behind the retinal plane. This condition is called *farsightedness* or *hypermetropia*.

N

Napoleon's march to Moscow. The Napoleonic Wars were those wars waged between France under Napoleon I and various combinations of European nations from 1803 to 1815. They were a direct continuation of the French Revolutionary Wars (1792–1802). With overwhelming numbers the Allies finally defeated Napoleon. One of the best-known graphic diagrams ever made is one made by Charles Joseph Minard in 1869. This 24 x 51,8 cm graphic explains Napoleon's problematic march to Moscow and back.

Minard (1781–1870) combined statistical data with a timeline treatment. He plotted six variables, showing the size of the French army during its advance and its retreat, its location on a two-dimensional surface, the direction of the army's movement with reference to places and time, and the freezing temperature on various dates during the retreat from Moscow. Beginning at the left on the Polish-Russian border, near the Niemen River, a thick band in the diagram shows the initial size of the army. Forces numbering more than 422,000 men invaded Russia in June 1812. The decreasing width of the band in the graphic indicates the declining size of the army at each place on the map. Only about 40,000 soldiers survived Russia. Finally only 10,000 men returned back into Poland from this devastating campaign.

Narrow and condensed type has been regarded as cramped, economical, precise, restrictive, and un-assuring.

National Television Standard Committee. See *NTSC*.

Natural Colour System, *NCS*, is a colour description system, developed during the 1970s. From a perceptual point of view, we perceive six colours as “pure.” Black and white are achromatic colours. Yellow, red, blue, and green are chromatic colours. These six colours are called elementary colours. All colours that are not pure elementary colours have a varying degree of resemblance to several elementary colours. Thus every possible colour can be described with a specific location in a three-dimensional model, a twin cone, called the “NCS Colour Solid.”

The chromatic elementary colours yellow, red, blue, and green are all located on the circumference of the *Colour Circle*. One hundred steps, thus describing the hue of a colour, can divide each quadrant.

The *Colour Triangle* is any vertical sector through half of the NCS Colour Solid. It is used to describe the nuance of a colour, i.e., its degree of resemblance to white, black, and the pure chromatic colour of the hue concerned (chromaticness).

When we want to describe a colour using the colour triangle and the colour circle, it is done in the following sequence: blackness, chromaticness, and hue. For example, a colour of 10 percent blackness, 80 percent chromaticness, and with a hue of Y70R will have the notation 1080–Y70R. The NCS places emphasis on qualitative variation in the colour sensation whereas the Munsell System is based on equally spaced visual scales. Both systems are based on surface colours.

Natural law. See Closure principle.

Navigation. When we browse through a paper, an encyclopaedia, or a hypermedia system, we navigate using a combina-

tion of alphanumeric information (headings and subheadings) and pictorial information.

Navigation in hyperspace. The interest in hypertext systems other than the WWW has decreased during the last years. Around the world software designers are trying to create systems that combine the unique capabilities of computers and the human capabilities of understanding complex information structures. It seems to be a good idea to use a structure that is already familiar to the readers. The structure of a library, the departments, the bookcases, the bookshelves, the books on the shelves, the chapters in the books, and the sections in the chapters may be recommended in many cases. For large hypertext or hypermedia structures one or more indexes may be the best way to access information. Since any page in such a system may be printed on paper it is essential that each page include the necessary administrative data such as the company logo, the name of department, the document number, revision status, revision date, name of persons responsible for the contents, and name of persons responsible for the approval of the information, and security class.

NCS. See *Natural Colour System*.

Nearsightedness. See *Myopia*.

Negative effect. It should be remembered that pictures could have a negative effect on learning. When too many pictures are used, readers may ignore many of them—the opposite of attention. Haphazard use of visuals may lead to minimal or no instructional gain and gradual loss of effectiveness as an instruc-

tional tool. Cognitive and decorative functions should never be confused or mixed.

Negative indents may be used in reference lists. Here a paragraph extends into the left or into the right margin. The width of an em dash is commonly used for paragraph indentation. This width is equal to the height of the type. So in 10 point an em dash is 10 points wide. Negative indents may be used for reference lists, numbered lists and lists with bullets, and other characters like stars, squares etcetera. Negative indents may also be used in texts where it is very important to draw attention to each new paragraph. However, indenting of every sentence will slow down the reading speed. See *Indents*.

Negative results. When we design information and learning materials, it is very important that the materials are reviewed and approved by people with expert knowledge in the appropriate fields. The effort put into training and learning may actually give a negative result, and the learner may end up less competent than before the learning experience. This may happen when he or she uses information and learning materials which:

- 1) Is technically incorrect or irrelevant, and provides the wrong information.
- 2) Is badly structured and therefore is hard to understand.
- 3) Has poor legibility of text and pictures, and therefore is hard to read.
- 4) Has poor readability of text and pictures, and therefore is hard to understand.
- 5) Has low reading value, and is not at all worth reading for the intended audience.
- 6) Is ungrammatical, badly spelt, and incorrectly punctuated.
- 7) Has confusing and misleading pictures, not at all relevant to the content of the text.
- 8) Has a writing style that is inconsistent and does not conform to an expected standard.
- 9) Is not consis-

tent throughout all its sections with respect to text, pictures, typography and layout. Unfortunately, all of these situations are quite common today. Using the “wrong” materials means spending extra time and extra money.

Negative space or *passive space* in a visual is the part that is not filled with picture elements. The negative space is usually the background. *Active space* or *positive space* in a visual is the part representing different objects. Space has no meaning in itself, but it may be used to separate or bring together different picture elements.

Neolithic art have thirteen main categories of motifs: face motifs, circles, rayed circles, crosses, spirals, arcs, ovals, scalloped outlines, hurdle patterns, fir tree motifs, zigzag patterns, triangles and lozenges, and cup-marks. There are several versions in each category.

Neolithic period. See *Prehistory*.

Neolithic rock designs. See *Curvilinear decorations, Rectilinear decorations*.

Nested indents are a form of indentation in which each subsequent indent is set relative to the previous indent, and not relative to a margin. Nested indents may be used to graphically show the relationship between sections, sub-sections and paragraphs within a text. Tables of contents often have nested indents to show each successive level. See *Indents*.

Network operators invest vast sums on the expansion and maintenance of their digital networks. They are capable of handling text, audio, video, pictures, and data. Governments are

commissioning an increasing number of studies to examine the need for control systems, ethical rules, and new sources of tax revenue. Copyright of and responsibility for factual information, i.e., data in constant need of change, processing and updating by many different people, are among the most difficult issues being addressed.

Network visualization is a pictorial representation of edges and vertices of a graph. See *Visualization*.

Neutral. Some researchers argue that many illustrations serve no important function for student learning. The effect is neutral when the pictures do not add to the text of the textbook.

New Century Schoolbook is a common serif typeface.

New disciplines. Academic disciplines constantly evolve. Some disciplines develop in different directions and form new disciplines. Some disciplines partly overlap other disciplines and form new disciplines. Information design was deliberately “put together” with elements from several different areas. This happened at the same time in different parts of the world, and information design of today has its origin and its roots in different areas.

New media literacy, *multimedia literacy*, *screen literacy*, is the ability to cope with the numerous media in use today.

Newgrange is a large prehistoric megalithic monument in Ireland. A well-organized farming community constructed Newgrange over 5,000 years ago. The mound is 79–85 meters in diameter and 13.5 m high and it is built of 200,000 tons of stone and alternating layers of earth. On the shortest days of the year,

the winter solstice, the first beams of light from the rising sun illuminates an altar-stone inside the main burial chamber. This special construction shows a deep understanding for the importance of special illumination. Many large kerbstones and stone slabs have carved decorations with "basic designs." See *Stone circles*.

Niépce. The French inventor Nicéphore Niépce (1765–1833) made the worlds first photograph in 1825. His technique was called heliography.

Nightingale. The British nurse and statistician Florence Nightingale (1820–1910) was the founder of modern nursing. She tended to wounded soldiers during the Crimean War. Florence Nightingale was a pioneer in the visual presentation of information and statistical graphics. She developed and made extensive use of *polar area diagrams*, a special form of pie chart, in her reports on medical care in the Crimean War. This type of diagram is also known as the *Nightingale Rose Graph*. Florence Nightingale is famous for her *Diagram of the causes of mortality in the army in the East*, 1858. Civil servants and Members of Parliament were unlikely to understand traditional statistical reports.

Nipkow. The German student Paul Gottlieb Nipkow (1860–1940) developed the first electromechanical television in 1884. He used a spiral-perforated disk to divide a picture into a mosaic of points and lines. Entirely new designs followed. See *Baird*.

Noise may intrude on various occasions and interfere with the communication process or processes. Every "perception," such

as a visual sensation, is actually composed of a large number of different sub-components that are aggregated into a single holistic impression.

Nominal quotient. The nominal quotient gives the total number of nouns, prepositions, and participles divided by the total number of pronouns, verbs, and adverbs in the text. A good information text has a quotient of slightly more than 1.0. A text with a lower nominal quotient seems “chatty,” whereas a text with a higher nominal quotient is cumbersome and hard to read.

Nomogram is a schematic picture. There are two kinds of nomograms: *Abac* and *Alignment* chart. See *Graphs*.

Non-figurative representations, *verbal symbols*, include verbal descriptions, nouns or labels, and letters and characters. See *Representation*.

Non-linear presentations are lists, tables, linear branching, matrixes, and, of course, all kinds of visuals.

Non-linear structure. Hypermedia and expert systems might allow for almost totally non-linear structures. The user would then not be restricted by pre-defined structures, and thus be able to navigate freely between different nodes with information.

Normal curve is a schematic picture. See *Graphs*.

Normal perspective. A “normal” way of viewing could be said to represent the eye-level perspective or normal perspective. See *Eye-level perspective*.

Notes tend to fray the reading fabric. If notes are required, they may be collected in a numbered list at the end of each chapter immediately before the bibliography, and arranged like a list of items with numbers instead of characters to mark them. Occasional notes and brief references may be placed as footnotes at the bottom of the page, or sometimes in the left or right margin.

NTSC. In the US, Canada, and Japan a system called *NTSC* is used. NTSC, *National Television Standard Committee*, is both the name of the authority, which developed the American colour television-system, and of the system itself. The NTSC is an analogue system, which has been adapted over the years. First appearing in black and white in the 40's, then colour was added in 1953, and finally, stereo audio was added in 1982. NTSC uses 525 lines of resolution. In this system 60 half images are produced every second, and they are combined to 30 whole images per second.

Number of words in a sentence appears to exert the strongest effect on reading rate and reading comprehension.

Numbering. To achieve a clear structure we can use a combined numbering and lettering system. Main points in a text are traditionally labelled with Roman numerals (I, II, III, IV etc.). Sub points of the first degree are traditionally labelled with capital letters (A, B, C, D etc.). Second-degree sub points are traditionally labelled with Arabic numerals (1, 2, 3, 4, etc.). Numbering and lettering systems can be combined with typographic cueing of headings. Headings set in different type versions aid comprehension of the material.

Numeracy is the ability to understand and work with numbers and other mathematical concepts. To be numerically literate, a person has to be comfortable with logic and reasoning. Innumeracy or numerical illiteracy refers to a lack of ability to reason with numbers. Economic literacy, financial literacy, and statistical literacy belong to this category.

Numeric data are often used to illustrate situations such as relationships between variables and parts of a whole. Data can be presented in many formats. Graphic formats include comparisons of numbers, lengths, areas, volumes, positions, and also comparisons of different combinations of these variables. Discriminations are most readily perceived and learned when the differences between stimuli are maximal. If you wish to be clear, choose clear examples.

Numerical illiteracy refers to a lack of ability to reason with numbers. See *Numeracy*.

O

Object-oriented image, or *vector image*, is based on mathematical functions and is composed of lines and closed polygons. A coordinate system holds all the information on where lines, circles, squares, rectangles, and other shapes start and stop. Shapes can be filled with various patterns and delineated with different lines. This means that an image can be scaled up and scaled down without loss of quality. The image is re-drawn according to the specifications set by the new size.

Object. See *Sign*.

Objective. An objective refers to what the sender wishes to achieve with a message. It describes an *intended result* rather than a process. The objective of an information material is usually linked to some utilitarian aspect in which the receiver is supposed to understand how something works or how to behave in a given situation in order to avoid or resolve a problem. See *Objectives*.

Objective set law. See Objective set principle.

Objective set principle is also known as the objective set law. Some phenomena are perceived more strongly than others. For example, two lines that almost form a right angle are perceived as a right angle. This refers to our perception tendency towards a stable group. Once perceptual units are seen as a group, perception will try to retain this group. Horizontal lines are often perceived as being shorter than equally long vertical lines.

Objectives. In graphic design, information design, instructional design, instructional message design, mass design, mes-

sage design, and persuasion design it is important to define the purpose and the objective with any message, always keeping the intended receivers in mind. See *Advertising objectives, Clear objectives, Course objectives, Educational objectives, Graphic design objectives, Groups of information materials, Information design objectives, Instruction design objectives, Learning objectives, Mass design objectives, Message design objectives, Message objectives, Message objectives diagram, Performance objectives, Persuasion design objectives, Reading objectives, Visual literacy objectives.*

Objectivism. See *Constructivism.*

Objects. It is known that objects and pictures of objects are remembered better than their names.

Oblique is an “artificial italic.” It is formed by electronically slanting a vertical typeface. Italics, however, are specially designed.

Oblique perspective is a *two-point perspective*. All lines vanish in two directions to two different vanishing points.

Observations. Producers of visuals for information may benefit from observing how receivers and “actual users” use information materials in normal situations. Observers could also interview “members of the audience” about how, why, and when they use visuals.

Occipital lobes at the back of the cerebral cortex in the brain process vision.

Occupational roles. Examples of occupational roles related to information and information material are archivist, book editor, chief editor, computer typographer, consultants, design assistant, designer, desktop publisher, dictionary editor, documentalist, draughtsman, editor, editor of cultural pages, editor-in-chief, exhibition producer, expert, foreign editor, gatekeeper, graphic artist, graphic planner, illustrator, info-master, informatic, information broker, information designer, information manager, information secretary, information stage designer, information-provider, journalist, librarian, linguist, map editor, marketer, night editor, non-fiction writer, photographer, picture editor, press secretary, producer, social information-provider, teacher, technical information-provider, technical writer, translator, typographer, webmaster.

OCM, Outline of Cultural Materials. See *Outline*.

Offset lithography. In offset printing, text and images are copied to a photosensitive plate of paper, plastic, or zinc. In plate-making the image area is covered with ink that is grease-receptive. The non-printing areas are made water-receptive. The plate is mounted on a rotary press. During the printing water and printing ink are supplied by special rollers. The paper, or other substrate, picks up the impression of the image as the it travels between the rubber-covered blanket cylinder and an impression cylinder. There are many kinds of offset printing machines, from small office machines to very large industrial machines. Sheet-fed and web-fed presses may be used. In large offset printing machines it is possible to print four colours directly in one combined process. Today offset printing is very

common for printing of newspapers, books, and most kinds of graphical products.

OH. See *Overhead transparencies*.

OMAX, or *Omnimax*, is a wide-film system giving a very large picture area. The film-frames are put “lengthwise” on a 70-mm film and not “crosswise” as IMAX on normal 35-mm film. OMAX is shown inside a dome. The audience sits high up in a slanting auditorium, with a shorter distance to the screen.

Omnimax. See *OMAX*.

One-dimensional representations, like words in a verbal message, “flow” in a relatively fixed and often unambiguous form along a time axis. The simplest form of a “one-dimensional” representation is a simple acoustic signal, such as a baby’s cry. A higher degree of complexity is found in texts and music. Music is always structurally more complex than text but can, of course, sometimes be “simple” in content.

One-point perspective, all lines vanish in a single point in the picture. See *Central perspective*.

On-line databases are offered by different by different providers, such as the printing companies, publishing houses, computer manufacturers, and libraries.

Online education is a kind of E-learning. See *E-learning*.

Online instructional design. Many students say that the concept and the logical structure of a course are the most important aspects to them. Typical comments include:—“Poor course design and structure can make for confusion in finding

assignments, due dates, etc.”—“Students easily get apprehensive, agitated, and panic stricken when they have questions that go unanswered for days.”—“Both the visual layout and the information architecture need to be user-friendly, and attractive.”

Online learning. A selected list of instructional design recommendations for successful online learning includes the following views: 1) Both the visual layout and the information architecture need to be user-friendly, and attractive.... 2) All visual, graphic and navigational tools need to be relevant to, and consistent with the content and aims/objectives of the course; they also need to be employed in a systematic, consistent manner ... (e.g. headings have to appear with the same font type, size and colour throughout the online environment to confirm their role). 3) “The interface design must provide a sense of human interaction, and helpfulness and responsiveness to the needs of learners studying in an information rich, self directed medium. Learners need to feel confident that they know where they are at any one point in the course and they can easily make contact with others as the need arises.”

Online teaching. Students and faculty are placed in a position to reconsider their identity (subjective self) and how the class/community *design* invites them to rethink who they are as a student. Misunderstandings are easier via e-mail, because you do not know in what circumstances the receiver is when reading the message. In short, introverts, reflectors and verbal-visual learners seem to get the best out of this type of delivery. As for the rest, they need to adapt to e-learning with the tutor's help and support especially as far as instructional activities (variety, variety, variety!) are concerned. Students do not know what to

expect from e-learning and consequently how they themselves will respond and react to it.

OODA-loop (Observe, Orientate, Decide, and Act), also called the *Boyd cycle* is a process dimension of a case study. The first phase in the process addresses issues like key concepts and definitions, the second phase looks at major arguments and evidence, the third phase introduces assumptions and methodology and the fourth phase concludes and summarizes. Each step depends on the content. Problems at the tactical level differ from problems at the strategic level. From military literature it could be simplified to say that tactics are how to win the battle, operation is how to win campaign, and strategy is how to win the war. The level of problems differs in abstraction and time.

Open ended boxes are boxes with rules only at the top and bottom.

Operant conditioning. In operant conditioning, or *instrumental conditioning*, an organism learns that a response it makes will be followed by a particular consequence (operating on the environment, thus the term “operant”). Animals engage in trial-and-error behaviour. The more a specific behaviour is practised, the more strongly it will be “learned.” The *ethological approach*, however, challenges these assumptions. In accordance with the ethologists, what an animal learns is constrained by its genetically determined “behavioural blueprint.”

Operating instructions is a term for a group of information materials in the category *Instructions*.

Operative memory. See *Short-term memory*.

Oporinus. See *Vesalius*.

Optic nerve. The optic nerve has about one million optic nerve fibres leading from the ganglion cells. In the fovea there is an almost one-to-one connection between cones and fibres, whereas as many as 600 rods may be connected to one optic nerve fibre in the outer periphery of the retina. This helps to explain why visual acuity is best in the fovea.

Optical media has been developed at a rapid pace. This is especially true of 12 cm optical compact discs. They can be viewed as “distributed databases.” A number of different systems with different characteristics are available.

Optima is a common sans serif typeface.

Optimum legibility. To achieve optimum legibility it is known that the technical quality of type should be high. Letters can be hand-written or they can be created on machines such as typewriters, dot-matrix impact printers, laser printers, or typesetters. Machine-created characters, type, are well-formed, and consistent in their size and style. Traditionally, type was the old wooden or metal cast of letterforms. The individual pieces of type were put together and locked up into forms. Then the type was coated with ink. Sheets of paper were placed on the type, pressed with a roller, and then removed. Each sheet of paper then contained an impression, an image, made from the real type. The use of physical letterforms was replaced by a system that used photographs of the letters’ images. Today phototypesetting machines work with digital images of characters. They work with a good resolution and create high quality typography.

Oral presentations. An essential difference between the spoken and the written message is the time available for transmitting them. The speaker and the listeners communicate in real time. The writer and the reader can take the time they need. A widespread use of visuals in oral presentations is evident, as is the need to improve the quality of such presentations. It is possible that speakers underestimate and listeners overestimate the average length of a presentation. Presenters have a tendency to overestimate their own use of visuals. Speakers appear to overuse word visuals. Quite often it is obvious that speakers are aware of the poor quality of their visuals.

Orbis Sensualium Pictus, (The Visible World in Pictures), Comenius' illustrated textbook, was first published in 1658. Comenius presented information on the world and on mankind in closely related pictures and words. Through 150 illustrated chapters the book was designed to teach the student Latin with the help of short, but memorable sentences in the child's own tongue. Considered by some scholars to be the first picture book for children, the *Orbis* brought into the home a complete world, combining subjects and modes of life from near and far. This book was widely used in both Europe and the USA for some 200 years. See *Comenius*.

Ordered perception. The reader must see the relative ordering of values along a perceptual dimension. Size, position and value are variables that are ordered. Objects can easily be arranged objectively from least to greatest. This is often used in diagrams.

Organisation. There are many different tasks and skills that may be needed in the design and production of information and learning materials. A number of tasks and roles, or “competence areas,” are the same for any information material. Different people work on different assignments, to some extent at the same time. In a large project there may be a need for many different skills, such as a project manager, a subject matter manager, a project secretary, a number of sub-project leaders, subject matter experts, technical writers, technical editors, translators, information brokers, graphics editors, photographers, illustrators, fine art artists, subject matter reviewers, linguistic consultants, terminology experts, pedagogues, graphic designers and web-masters. In a small project it is usually not possible to employ a large number of experts. However, also in small projects we need to organise various reviews.

Origin. See *Information design genus*.

Originator of term. The people who create concepts and terms may be called “originators of terms”. They should get into contact with the “terminology coordinators.” See *Terminology, Terminology work*.

Ornaments. Various ornaments and patterns can be used to separate different sections in a text. In instructional materials they are often used to mark specific activities. They can also be used for decoration, to make a more aesthetically pleasing or artistic product. Dingbats is a special PostScript font in desktop publishing systems.

Orphans. In typography an “orphan” is defined as the last line of a paragraph when it is alone at the top of a column. See *Widows*.

Orthographic drawings do not show an object in perspective, but in “scale.” Objects are represented as they are remembered.

Other positional perspectives. This group of positional perspectives has two types: 1) *geometrical perspective*, and 2) *multi-view perspective*.

Outdentation, or a *hanging indent*, is the reverse of indentation. It is often used in lists with bullets, and in lists with numbers. It may also be used in reference lists, for the lines following the initial line in a reference. See *Indents*.

Outline. Many museums use *Outline*, OCM (Outline of Cultural Materials) for classifying pictures. Outline was designed to be a general classification and code system for social and cultural subjects and operates with computerized routines. Classification is influenced by the perceptions of the individuals doing the coding. This makes it difficult for a visitor to find pictures complying with her or his requirements. See *Inconclass*.

Outline letters. See *Emphasis in text*.

Overhead projector is a projector used to project overhead transparencies. Room illumination (at least illumination near the screen) must be reduced. To prevent image distortion, the top of the screen must usually be tilted forward. The projector should be put at such a distance from the display screen that the complete image is projected on the screen. If parts of the image

fall on the wall, outside the screen, this may be quite disturbing. It is also very important that the whole image is in focus. Dirt on the transparency, on the lenses, or on the screen is also disturbing and makes the image less effective. See *Overhead transparencies*.

Overhead transparencies, *OH*, can only be projected with an overhead projector. In Europe the actual plastic film is 210 x 297 mm, and the picture surface is 190 x 245 mm. Many speakers mainly use text transparencies, or “word visuals,” containing key words in attempting to supply an overview, clarify, reinforce, and summarize complicated arguments. These texts must be brief, concise, and easy to read. For good legibility, characters should be large, distinct, and boldface, never less than 5–6 mm high when projected in a room the size of a normal classroom. Larger rooms require larger character sizes. Today many speakers have left overhead transparencies and slides and use PowerPoint presentations and other similar digital systems. See *Legibility of projected texts*, *Overhead projector*.

Overhead view is a kind of level perspective that is used in computer and video games. Here the vantage point is only a few feet above human height.

Overlapping perspective. When certain objects are placed in front of other objects this will enhance the impression of depth in a picture. The overlapping perspective was common in European mediaeval art. The *overlapping perspective*, *cropping perspective*, or *playing-card perspective* should always be used with cautiousness—in a correct, logical, well thought-out and consistent manner. The risk of misinterpretation is obvious.

Own goal. In my own work the goal has been to study the presentation of visual and verbal and visual messages in information and learning contexts in order to gain a better understanding of the conditions related to the design, use, and interpretation of such information. Most of my own work has been related to audience interpretation and perception of verbal and visual messages, to visual literacy and to the question of a visual language and its representations.

P

Package design. The function is to inform, and also to protect the content in the package.

Page. For reports, and similar documents, it is reasonable to use one, two, or three columns on the page. In multi-columnar layouts the narrow columns should have unjustified lines. In a justified text the distances between the words are too long, creating white “rivers” of space in the text columns. Consistent use of columns will help to establish a regular pattern throughout a project. There are many possibilities for placement of the page numbers. They should be clear and easy to find. Usually readers are likely to look for page numbers in the margin at the bottom of the page. However, this should not to be considered a rule.

Page composition. Headings, text, pictures, margins and “empty” space can be used to aid communication when used in a consistent way. Learners are most able to build connections between verbal and visual representations when text and illustrations are actively held in memory at the same time. This can happen when text and illustrations are presented in close connection on the same page.

Page format index. See *Format index*.

Page numbers indicate arbitrary divisions of the text. For technical reasons some books contain more than one series of page numbers. For example, technical manuals and instructional materials often use a separate numbering series for each chapter. Then a single chapter can be updated without reprinting the whole manual. The running head includes the name of

the publication, the issue date, or other header or footer style material. In all kinds of reference materials, it is important to have page numbers, folios. The reader can find information in the material by using the table of contents and/or the index.

Page numbers placements. Page numbers should be clear and easy to find. There are many possibilities for placement of the page numbers. They can be put to the left, in the middle, or to the right in the header or in the footer. Page numbers are sometimes also put in the margin. In products with large page sizes, it is usual to put page numbers in the header. In products with small page sizes, it is quite common to put page numbers in the footer. However, this should not be considered a rule. The important thing is consistency.

Page size. Often the available paper defines the possible page sizes. The use of international standard paper sizes can aid communication. For reports, and other similar documents it is reasonable to use one, two, or three columns per 8 1/2" x 11" page. The same is valid for the A4-size, which is standard in Europe.

Pain threshold is the highest sound intensity we are able to tolerate.

PAL. Most Western European countries have agreed on a colour television-system called *PAL*, Phase Alteration Line. PAL is also used in Australia and in several countries in Africa and in the Middle East. 625 lines build up the television-image. Every line consists of a large amount of pixels. A colour television-receiver has a "shadow mask" with some 400,000 small holes for red, green, and blue, respectively. Our 50-periodical alter-

nating current is used to produce 50 half images per second. In one pass, the electron gun of the television displays every odd-numbered line of the image from top to bottom. In a following pass, the electron gun creates the even lines. Each pass takes 1/50 of a second. This process is called interlacing. The two image halves “interlace” and we see only one image. A black and white television uses 450 effective lines with each 560 pixels. Thus, a black and white television-image consists of 235,200 pixels. Most video systems have considerably worse resolution than broadcast-television. VHS has, for example, usually 248 lines. Super VHS has an improved resolution of 400 lines.

Palace Script is an example of the script type style. See *Script type style*.

Palatino is a common serif typeface.

Panorama is a schematic picture. See *Drawings*.

Paper and ink. In all graphical media the quality of the paper and ink is of vital importance for the final result. The paper has its specific bulk, finish, grain, texture, and weight. It may be stiff or floppy. It may be glossy and shining or matte and maybe dull. It may be thick or thin. Thin lines, in serifs on small type sizes, may require a harder paper than normal lines and larger type. The printing technique used will affect the type of paper needed. The quality of ink is also an important factor in graphic communication. All these factors affect legibility and our reading comfort and also our perceived value of the product. The degree of contrast between the colour of the ink and the colour of the paper should be optimum. For text printed in black all paper surfaces are equally legible if they have a reflectance of at

least 70%. The most legible combination is a black text on a light yellow background. In a normal reading situation, black print on white paper is over 10% more efficient than white on black.

Paper format index. See *Format index*.

Paper size. There is one widespread international ISO standard and a local standard used in North America. Paper sizes affect cards, envelopes, printed documents, stationary, and writing paper. All *ISO paper sizes* are based on a single aspect ratio of the square root of two, approximately 1:1.4142. The base for the system is the A0 paper. An A0 (A zero) paper has an area of 1 m², with the sides 841 and 1189 millimetres (33.1 in × 46.8 in). The most frequently used paper size is A4 210 by 297 millimetres (8.3 in × 11.7 in). A standard A4 sheet made from standard 80 grams per m² paper weighs 5 grams. See A series, B series, C series, D series, E series.

Paradigm shifts. A paradigm shift represents the notion of a major change in a certain thought-pattern. We will be able to witness some paradigm shifts related to information design.

- *Efficiency 1.* Information sector will be more efficient and effective.
- *Efficiency 2.* Production of information sets will be more objective-oriented.
- *Learning 1.* A learning revolution takes place outside of the traditional classrooms, and without traditional teachers.
- *Learning 2.* Emphasis on *learning* rather than emphasis on teaching.

- *Learning 3.* Faculty members will become *collaborators in learning*. However, teachers are not trained to do this.
- *Market.* Consumption of information does *not continue* to grow as quickly in the future.
- *Medium 1.* Access to the information required for maintenance (of heavy equipments and machines) will be on-line, and not necessarily in printed documents.
- *Medium 2.* Printed documents are replaced by on-line services.
- *Medium 3.* Visual communication will be even more important.
- *Message 1.* Focus on the information *content* rather than on printed documents as such.
- *Message 2.* According to the *encoding–decoding* model the sender is an encoder constructing “meaningful” texts. The receiver is a decoder, and may accept, negotiate or oppose the intended meaning.

Paragraphs. The end of a sentence should be determined by syntax rather than by a set width of a line. Readers prefer small text paragraphs to big ones. White space between portions of a text could be used as a cue to the readers that a new section follows. Often it is quite easy to divide the text in hierarchic and natural parts, portions, or sections. Natural breaks emphasized by typography are helpful. See *Terminal mark*.

Paragraphs extra space. Providing “extra white space” between paragraphs and between larger portions of the text provides valuable cues to the learners that a new section or a new type of activity follows.

Parallel perspective. In a parallel perspective, the distance is endless, and parallel lines of an object are parallel in the picture too. See *Line-based positional perspectives*.

Parallelepipeds are a kind of schematic picture. See *Diagrams*.

Parietal lobes of the cerebral cortex in the brain are important association regions that combine information from different sources.

Partitive concept system shows the different parts that together form a super ordinate concept. See *Conceptual models*.

Parts of a whole can be presented using comparisons of lines as well as comparisons of areas.

Parts of communication. In information design we can study the whole communications process, for example with respect to social aspects or “noise” in the system. We can also study aspects related to the sender, the representation, and the receiver.

Passive space, or *negative space*, in a visual is the part that is not filled with picture elements. The negative space is usually the background. *Active space* or *positive space* in a visual is the part representing different objects. Space has no meaning in itself, but it may be used to separate or bring together different picture elements.

Passive voice. Avoid a complicated word order and subordinated clauses in information design. Constant use of the passive voice can make your writing imprecise and difficult to follow.

Passivity. The contents of movies and television programmes are presented in a preordained fashion, decided on by the producer. This preordained fashion tends to encourage passivity in the viewers and to perform at a low cognitive level. The same is true of prepared oral presentations, like formal speeches and rigid lectures. However, the reader of a book or a newspaper digests the textual and the pictorial information at his or her own pace. Interested readers are active and perform at a high cognitive level. Readers that are not interested in the subject matter easily become passive.

Past experience principle is also known as the previous experience principle, and as the law of past experience. New impressions are dependent on, and interpreted against the background of our previous individual experience, learning and knowledge. Our assessments and our experiences change over time and affect our way of associating. We sometimes perceive only what we want to perceive. It is easy to jump to the wrong conclusions. Messages that are contradictory often create more confusion than they provide help. A torrent of information bombards us from the outside world.

Patent officers. In commercial technology projects the patent officers should first review any information material, with respect to patentability matters. Members of the group of intended users should take part in the production process. They should be asked to discuss and review the information material at various steps in the process.

Pathos is the emotional appeal that mainly works indirectly by associations to the expressions. Pathos may evoke feelings of joy

or fear, of formality or informality. By logos is meant the rational appeal.

Paulinus of Nola (354–431). The Bishop argued that the Latin texts in scrolls on the walls in the churches served as clarification of the messages in the pictures in the churches.

Pedagogical model. In information design the emphasis is on the learner, not on the teacher or the technology. Students need a comprehensive *Study guide* with information about the course. During a course students may use a Virtual classroom when they work together with group assignments. Here they can upload their own individual assignments. In this way all assignments are available for all students in the class.

Pedagogues are needed to review any learning material, checking that it is sufficiently legible and readable, and that it has good reading value for the intended audience.

Peirce. See *Sign*.

Perceived messages. There is often a considerable discrepancy between the sender's intended message and the message perceived by the receiver, both as regards words and images. It is sometimes doubtful whether receivers perceive anything. Everything usually works better when words, pictures and graphic design are allowed to interact. In perceiving a message the receiver use sensory organs and the nervous system. When a message is internalized the receiver has got new emotions, new experiences, new feelings, and new knowledge. Often individuals will interpret the same representation in different ways. Here age and gender, cultural, economical, historical, political,

religious, and social factors may be important. The internalized message will influence the interpretation and understanding of future and related messages.

Perceived personas. See *Typeface personalities*.

Perceived size. The perception of distance is related to the perceived size, and the perception of size is reciprocally related to the perceived distance.

Perception is a collective designation for the different processes in which we obtain information about the outside world. We see dots, lines, areas, light and dark in an organized way. One of the simplest perceptual organizations is that of “figure and ground.” We select some elements in a picture as the figure, and the remaining elements constitute the background. When a message is internalized the receiver has got new emotions, new experiences, new feelings, and new knowledge. Adult perception tends to be holistic rather than detail-oriented. All elements in a visual should contribute to clarity. Our perception varies as a result of a number of factors, such as cultural and social status, the time and stage of our development, our memory, and other cognitive processes. See *Facilitating perception, Gestalt laws, Perception of colour, Perception of layout, Perception of pictures, Perception of text, Perception of verbal language*.

Perception of change. The least possible difference that can be detected between two similar stimuli is called *the just noticeable difference, or the differential threshold*.

Perception of colour. Use colours should with care. Yellow, orange, and red hues are perceived as active and warm colours.

Red evokes feelings of strong emotions. Violet, blue, and blue-green are cool and passive. Blue is often used to represent truth and honesty. White is often associated with innocence and purity, and black often represents evil and darkness. However, it should be noted that certain colours have different meanings in different societies. See *Legibility of colour, Perception*.

Perception of layout. The layout may aid or hinder perception of the content. We read texts as “word pictures,” not letter by letter. Readers tend to dislike both very short and very long line lengths. The optimum line length quite often seems to be about 1 1/2 alphabets–42 characters. Pictures are perceived more rapidly and readily than text. Sometimes image-enhancements intended to improve the interpretation of image content get in the way of the actual message. A number of studies demonstrate how graphics activate learner’s cognitive processes. See *Perception*.

Perception of pictures. Prior experience and context are very important. The pattern for eye movements and fixations depends on what we wish to see, or what we are told to see in a picture. The design of a picture can be changed a great deal without any major impact on the perception of the image contents. Open and light forms are perceived as being larger than closed and darker forms of the same shape. Colour and grey scale can be used to influence the perception of size. See *Perception, Perceptual constancy*.

Perception of text. Perception of text requires slow and sequential processing, and it is always relative. Reading a text is very structured with several eye fixations on each line. The end

of a sentence should be determined by syntax rather than by a set with of a line. It may take only 2–3 seconds to recognize the content in an image, but 20–30 seconds to read a verbal description of the same image, and 60–90 seconds to read it aloud. It is easier to assimilate and profit from a rich language by reading than by listening. Pictures that are relevant to the content of a text will facilitate learning from reading prose. We will remember more from a a graphically complex text than a “plain” text. Prior experience and context are very important. See *Perception*.

Perceptions. P in the TAP-model. Perceptions consist of the three perception principles most critical for instruction designers: figure/ground, gestalt, and hierarchy.

Perceptual aesthetics is based on Gestalt psychology and its understanding of the perceptual process. It seeks meaning through the process of becoming or developing according to nature through perceptual dynamics. This provides us with a unified approach to art that reveals a cross-pollination of perceptual insights and aesthetic insights. A perceptually based approach to art provides a simple and more basic system of aesthetic judgement than do approaches based on morality, contemporary manners, and taste of style.

Perceptual constancy. We can view a picture, a symbol, and a text from various distances and various angles and still get the same perception of the content. Our minds constantly fill in missing details and complete images, without our realizing that it has happened. See *Colour constancy*, *Contrast constancy*, *Shape constancy*, *Size constancy*.

Perceptual learning. There are two perceptual learning theories: the discovery theory and the enrichment theory. In accordance with the *discovery theory*, perceptual learning makes a person aware of stimuli he or she had previously not considered or overlooked. Perceptual abilities are modifiable by learning. The *enrichment theory* refers to our increased awareness and heightened response capabilities, as a result of perceptual learning. A practical example of this is that we learn to assume that a plate remains circular even though it may appear elliptical when we view it from most angles. The psychomotor domain may be seen as a progression in the design of the coordination that is required. Some motor acts occur automatically, such as retracting a finger from a fire or any hot item. Many motor skills, however, require practice. Everyday examples are walking and eating.

Perceptual motor-skills. Any acquired ability to perform tasks in response to sensory stimuli is often called *perceptual motor-skill*, *sensory-motor-skill*, and *psychomotor skill*. Perceptual motor-skill ranges from simple imitative movements to physical skills requiring complex neuromuscular coordination. The position of a skill on this continuum is a major determinant of the training approach that we have to adopt. A person usually learns a skill more easily with short, widely spaced practice sessions than with fewer and larger sessions. An expert instructor is often helpful to show the learner what a good performance is like, to diagnose and correct errors early in the motor-skill learning process, and to prevent the learning of wrong movements and bad habits.

Performance design. See *Design science*.

Performance objectives. It may be possible to test information sets with respect to different performance objectives. A performance, and a change in behaviour, must be observable. Thus subjective objectives defined by verbs like appreciate, assess, describe, discuss, evaluate, know, outline, and understand should be avoided. A statement of design objectives should include the conditions under which the required performance is to be observed and measured, when such conditions are relevant. Time and accuracy are often meaningful dimensions in assessment of objectives. When performance is qualitative rather than quantitative, the performance may be assessed by a group of experts.

Person schemas organise our knowledge of persons. Today media is our most important source of information of persons and groups of which we have no direct knowledge. See *Long-term memory*.

Personal context. Receivers are apparently capable of sensing far more information than is explicitly displayed in a given picture or text. Subjects express opinions about circumfluous events on their drawings. They also tend to feel that their particular interpretations are the correct ones. See *Context perspective*.

Personal–impersonal. In technical and scientific descriptions we want to focus on the subject matter. Here, the third-person point of view, or the impersonal style, is the most appropriate. In instructions and rules, the informal you is often the most effective form of address. In non-fiction books we may

want to discuss a topic with the readers. Here a personal style may be the most appropriate.

Perspective is the appearance of objects in space, and their relationships to each other and the viewer. See *Aural perspectives, Pictorial perspectives, Verbal-linguistic perspectives*.

Perspectives on subject. We can look at a specific area of art, science, technology, a specific system, or a specific product from several perspectives. Depending on our choice our impressions will be different. A manufacturer, a sales person, and a user will need different types of documentation, with different texts and different illustrations. Before starting to write or draw, it is important to decide which perspective we need to provide. It is important that it is easy to gain a general understanding of every topic.

Persuasion is 1) a process of communication designed to modify the judgements of others, and 2) success at modifying the judgement of others in intended directions. Persuasion is an important part of the daily life of every human being. What we eat, what we wear, whom we listen to, what music we prefer, what church we go to, and whom we will vote for in the next election are all affected by persuasive communication. We often fail to recognize when we are using persuasive communication, as well as when we are exposed to it. As a minimal condition, to be labelled as *persuasive*, a communication situation must involve a conscious attempt by one individual to change the attitudes, beliefs, or behaviour of another individual or group of individuals through the transmission of some message. Persuasion tends to be accomplished in both children and adolescents

almost exclusively through imagery. It is not likely that there will be just one, but several equally good options available for achieving satisfactory communication

Persuasion design comprises carefully planned information activities, where the goals are related to some kind of change in the behaviour of the receivers. Receivers are typically asked *to do* something. As a result of successful persuasion design the selected receivers will get a willingness to buy, apprehensions or prejudices, new beliefs, opinions and views, and reinforced attitudes. As a minimal condition, to be labelled as "persuasive," a communication situation must involve a conscious attempt by one individual to change the attitudes, beliefs, or behaviour of another individual or group of individuals through the transmission of messages. The information interpreter might be seen as a "possible buyer," a "prospect." See *Persuasion design objectives*.

Persuasion design genus. There are several persuasion design areas or disciplines such as advertising, persuasive communication, planned communication, and propaganda. Persuasion is used so frequently and is so pervasive in our daily lives that we often fail to recognize when we are using persuasive communication, as well as when we are exposed to it. See *Advertising, Planned communication, Propaganda*.

Persuasion design objectives. In persuasion design the main objective is to persuade the interpreter of the message to buy a product or a service, or to change his or her behaviour. The information interpreters might be seen as "possible buyers," "prospects." They may develop new prejudices, apprehen-

sions, willingness to buy, beliefs, reinforced attitudes, emotions, opinions, and views. It may be an advantage to use verbs like *appreciate*, *believe*, *buy*, *change* (behaviour), *desire*, *dread*, *fear*, *feel* (*relaxed*), *hate*, and *have* (*fun*) in the writing of persuasion design objectives. These verbs all denote observable behaviour. One example of a persuasion design objective may be: "For a warning 90% of the viewers should change their behaviour when they have seen the information once."

Persuasive. See *Persuasion*, *Persuasive messages*.

Persuasive communication. See *Persuasion*, *Planned communication*.

Persuasive messages. The goal of credibility, to persuade, leads to intended behaviour such as buying, giving, loving, voting, and so forth. A message that is not believed cannot persuade. A crude presentation (like a typewritten letterhead) or a hucksterish presentation (like the TV ads of auto dealers) may not be believed. Careful presentation may be required to overcome prejudices held by decoders.

Petroglyphs. See *Rock art*, *Rock carvings*.

Phase Alteration Line. See **PAL**.

Phenomenography is a method to investigate and describe the existing qualitative variation in how people experience different phenomena in the world around them. The object of investigation is the variation in which people experience, understand, see, conceptualize, or relate to different phenomena. From a phenomenographic perspective learning can be regarded as a conceptual change, or a leap from a lower to a hier-

archically higher conception. The focus is on the learner. The outcome of the learning process is analyzed in qualitative terms.

Phi phenomenon. The phi phenomenon is the optical illusion of perceiving continuous motion between separate objects viewed rapidly in succession. It is an apparent movement caused by luminous impulses in sequence. The psychologist Max Wertheimer defined the phi phenomenon in 1912. It formed a part of the base of the theory of cinema, applied by Hugo Münsterberg in 1916. See Beta movement.

Philosophy of art includes traditional, philosophical theories of art. Such theoretical positions inform, but are also tested by, critical and interpretive articles about particular types or examples of artworks. The information designer may focus attention upon the visual arts—as opposed to dance, literature, music, and theatre. Philosophers have encountered difficulties in framing a theory of “aesthetic perception” and, more importantly, of the remarkable variety of visual arts. Aestheticians discuss the philosophy of art from various perspectives, such as: the metaphysics of art, experiences of art, interpretations of art, production of art, and definitions of art.

Philosophy of beauty recognises aesthetic phenomena outside of the arts. These aesthetic phenomena can be found in nature, and in non-artistic cultural areas such as mathematics, morality, and science. The philosophy of beauty is concerned with fine arts only insofar as art may be beautiful. However, there is much more to art than beauty. In fact in many situations art may have little, or nothing to do with beauty. Until the 18th century, scholars regarded the study of beauty as the whole

or as the main problem of aesthetics. Since that time, aestheticians have devoted more efforts to the philosophy of art than to the philosophy of beauty.

Phonemes are basic units of sound without meaning. When combined, they form units with meaning. Spoken and written languages are formed from a limited number of phonemes (usually 20–40). These phonemes can be inter-combined in a limited number of ways. See *Morphemes*, *Syntagms*.

Phonology is the study of phonemes, i.e., the smallest units of semantic differentiation found in spoken language, and combinations of these units. The smallest written unit that fills a semantically differentiating function is called a grapheme.

Photo archives. Pictures are now being created more rapidly than at any time in history. Millions of pictures are produced every day. The contents of photo archives can help explain how others live, can illuminate the convictions of a community, and can document processes and procedures. See *Archives*, *Simple indexing*, *Stock photography*.

Photo fax. See *Telephoto*.

Photoengraving. See *Letterpress*.

Photographic copies have the highest hard copy quality. The chemical constitution of film and paper gives the limits for resolution.

Photographic messages. In journalism, a photograph should reflect reality without distortion. The most desired quality is credibility. Deliberately dishonest pictures and digitally ma-

nipulated pictures should not be used. In most cases photographs need a partnership with words that will confirm, clarify and reinforce their messages. Despite common belief photography is not a universal language. Viewers react to photos very personally. They interpret them in terms of their cultural heritage and environment. A photograph, therefore, may not communicate the same message to all viewers.

Photographic portrayal. An analysis of a photographic portrayal can identify positive and negative depictions of individuals seen in the photographs. Individuals are viewed more positively when they are shown walking, running or moving than just sitting or standing. Visuals with varied degrees of realistic detail can be used to reduce differences in the performance of learners with different levels of prior knowledge of the subject matter.

Photographic portrayal — camera angle. An individual appears powerful if he or she is photographed from below with the photographer looking up at the subject. An individual appears less powerful if he or she is photographed from above.

Photographic portrayal — camera placement. Photographs showing a subject straight on are more positive than those showing a subject from the side and much more positive than those showing a person from behind.

Photographic portrayal — eyes. Individuals shown with closed eyes are viewed more negatively than those shown with open eyes.

Photographic portrayal — facial expression. Individuals smiling are viewed as positive and individuals frowning are viewed as negative

Photographic portrayal — framing. The larger a person's face appears in a picture, the more positively our perception of that individual is. A close-up headshot of a person is more positive than a photo taken from a distance.

Phototypesetters. A phototypesetter usually works with high quality such as 1,250–2,600 dots per inch. This is good enough to create very small and close raster dots and to reproduce a great number of grey levels. Printouts are made on photographic materials, paper, or film, which are then used to produce printing plates. In order to get really good half-tone pictures, the quality of a phototypesetter is required.

Photographic portrayal — head position. Individuals looking straight at a camera look more in control than those individuals looking up or to the side. Individuals look least in control if they are looking down.

Photographic portrayal — posture. Individuals are viewed more positively if they are shown walking, running or moving. People standing are viewed more positively than if they are motionless.

Photographic portrayal — purpose of photo. The purpose of a photo is important for our perception of the person depicted.

Photographic portrayal — secondary subjects. Other people in a photograph, the context of the individual, may influence how people view a photograph.

Photographic style is a pictorial artistic style, a coloured photograph of the subject.

Photography. The word *photography* has its origin in Greek and means “writing with light.” There have been many different formats for still photography with miniature formats, film discs, film cassettes, standard 35mm film, and several larger film formats. The individual grains are irregular and run into and partly cover each other. Several camera manufacturers have digital cameras that store photographs on a small magnetic memory card. The photographs can be stored in a computer and printed.

Pica system, is a system for measuring size in typography. It is used in Great Britain and USA. Here 1 pica = 12 points = 12 pts = .1660 inch = 4.22 mm. 1 pt = .3516 mm (72,27 pts/inch). See *Size of type*.

Pictodiagram is a schematic picture. See *Diagrams*.

Pictogram is an ideogram that conveys its meaning through its resemblance to a physical object. See *Pictographic languages*.

Pictograph is a kind of diagram where each icon represents a given quantity. See *Diagrams, Rock paintings*.

Pictographic languages evolved in different cultures. They initially depicted objects and events as realistically as possible. Early *pictograms* were drawn with a stick in sand or clay, or on the wall of a cave with a piece of charred wood or bone. Ulti-

mately, people began depicting abstract concepts, largely magic or religious in nature, using pictograms to represent concrete objects. Pictograms of concrete objects were often combined to designate some abstract concept or thought. Pictograms became increasingly stylized and evolved into simple symbols or characters. Each character was equivalent to one or more concepts and came to represent a word. The Chinese language is an example of a living pictographic (ideographic) language in which each character represents one or more words. Other pictographic languages have developed in other ways. Sometimes pictograms can substitute for words.

Pictor. See *Albertus Pictor*.

Pictorial area chart is a kind of diagram with comparison of areas. See *Diagrams*.

Pictorial characters in space is a schematic picture. See *Diagrams*.

Pictorial dictionary. See *Picture dictionary*.

Pictorial dimensions. A picture has a height and a width, y and x-dimensions. New dimensions can be added to pictures stored in a database. We can attain an expanded time dimension by “before-now-after” picture storage. Or we can expand to a movement dimension by the use of animation. Not cropping too severely and retaining elements around the main subject attain a context dimension. A picture manipulation dimension occurs when we enlarge, shrink, change projection, crop or expand, delete, change, move, turn, supplement, isolate or combine different image elements in new ways. Departure from the

picture plane and utilization of overlays provide us with a supplementation dimension. We can attain a depth-enhancement dimension by employing windows opening on other databases

Pictorial perspectives. Usually the word *perspective* refers to a reproduction, on a plane surface, of a three-dimensional object, which conveys to the human eye the same impression of depth as that of the real object. Obviously, it is a matter of creating an illusion of depth; on a paper surface, for example. See *Psychological perspectives* and *Spatial perspectives*.

Pictorial style can be defined as the mode of expression employed by an artist in interpreting pictorial content. Several researchers have concluded that children prefer realistic art styles. See *Abstract art styles*, *Cartoon style*, *Expressionistic style*, *Photographic style*, *Realistic art styles*, *Representational style*.

Pictorial superiority effect. Our memory for a picture-word combination is superior to our memory for words alone, or our memory for pictures alone. See *Dual-coding memory model*.

Picture analysis. Various tests can be carried out to determine whether or not an information disseminator's intentions are accurately realized. Results of these tests can be used for revision of the picture description that, in turn, could result in even more effective informative material. A picture analysis can comprise a description and, possibly, a rating of picture language, contents, execution, context, format, medium, distribution method, sender, receiver, objectives, etc.

Picture analysis — aims. Why has the picture been produced? Has the picture been produced for advertising or propaganda? Are “hidden” intentions imbedded in the image?

Picture analysis — content. What is (are) the subject(s) in the visual? Is (are) the subject(s) easy to understand? What are the relationships of the different subjects? Is one part of the picture dominant over the others and why? Is the picture a typical or a non-typical example of the subject? What is the degree of realism and detail? What is the degree of credibility? How are motion, time, sound, and emotions expressed?

Picture analysis — context. What is the context? Is there a caption, texts, other pictures, or sound in connection with the picture? How is the layout done?

Picture analysis — distribution. How is the distribution organized?

Picture analysis — execution. What type of visual is it? Is the subject large and clear? What is the shape, size, colour, and contrast? How is the composition in terms of organization, centres of interest, and balance? What is the depth, picture angle, and picture height? What is the technical quality like? Does the picture have symbols and explanatory words?

Picture analysis — impact. Is the picture likely to have an effect on learning, human feelings, attitudes, or opinions? What impact is it likely to have?

Picture analysis — medium. In which medium is the picture used? Is the picture used in mass-media, in group-media, or in personal media?

Picture analysis — picture readability. What is the picture readability index?

Picture analysis — receiver. Who is (are) the receiver(s)? Do the receivers form a homogeneous group? Is the group small or large?

Picture analysis — sender. Who is (are) the sender(s)? Who is (are) the producer(s)? Are the views of the sender important to the use of the picture?

Picture analysis — visual language. Is the visual language clear and distinct? Is the visual language adopted to the culture and to the audience? Is the picture's "meaning nucleus" obvious? Does the picture contain a lot of insignificant information?

Picture area index is the average percentage of the text-face utilized for pictures. A book without any pictures will obviously have a picture area index of 0 (zero). When the index is 50 half of the total text-face in the book is covered with pictures. A picture area index of 100 leaves no room at all for any text in the book (except for texts printed in the actual pictures).

Picture circle is an attempt to provide a simple graphic description of the relationship between different types of pictures. We have symbols, schematic pictures, realistic pictures, and suggestive pictures. The spot in the centre represents *scribble*, which is the same all over the world and our first attempt to make pictures. Scribble is followed by hand-crafted visuals, and then and technically crafted visuals.

Picture dictionary, *pictorial dictionary*, is an illustrated dictionary where definitions of words are explained with drawings

or photographs. It can be a printed book or an online service. Picture dictionaries are often organized by themes. See *Visual dictionary*.

Picture editing. There is often a need for cropping and/or changing the scale of selected pictures. We need to get permission from the copyright holder/s to do any manipulation with pictures.

Picture effect. Visual presentation support is persuasive. There is a picture facilitating effect. Presentations using visual aids were more persuasive than unaided presentations. Research in the area of reading indicates that the type of pictures that are used is an important variable in reading comprehension. However, unfortunately this becomes less important in reality since most students do not attend to the visuals at all. Many pictures in textbooks obviously remain “unseen.” Neither teachers, nor students attend to these pictures. Pictures can also have a negative effect on learning.

Picture elements. See *Image morphology*.

Picture format index. See *Format index*.

Picture index is the average number of pictures for 100 pages.

Picture manipulation dimension. See *Pictorial dimensions*.

Picture perception and interpretation. How we actually create meaning is an area where much research still is needed. It can be concluded that:

- Captions heavily influence our interpretation of image content. To a large degree readers see what they are told to see in an image.
- Design of a picture can be changed a great deal without any major impact on the perception of the image contents.
- Different assignments may cause perception and image interpretation on different cognitive levels.
- Perceived image content is different from intended image content.
- There seems to be no major difference between gender in interpretation of image contents.

Picture placement. Several authors have noted that in materials for information a picture should be located as close to the relevant text passage as possible. It is usually a good idea to put pictures between paragraphs. Pictures within a paragraph will disturb the reading of the text. Above the picture, there should be at least one blank line, if, of course, the picture is not uppermost on the page, in which case the upper margin will provide sufficient empty space.

Picture quality is important for the credibility of a message. In many situations it may be better not to have any pictures at all than employing pictures with poor quality. Good picture quality can be defined as the degree of coincidence between the sender's and receiver's subjective perception of the picture and the reality (external or internal) represented by the picture.

Picture readability indexes. See *BLIX, PRI*.

Picture stone. See *Image stones*.

Picture style, or *pictorial style*. When people flip through 15-20 TV-channels in less than a minute to decide which programme they want to see they don't have the time to actually listen to the sound. Decisions are based on the pictorial style and content. When we receive a verbal and visual message we are rather quick to form a mental pre-understanding which influences our later perception of the message.

Picture tube. A picture tube or a *cathode ray tube* is the unit that produces and shows the picture on a television-receiver, computer, or terminal screen. The picture tube consists of an airless glass-tube. Its rear end contains a device that emits electronic rays, while the front part forms the screen. The back of the screen is illuminated when hit by the electrons. A picture is built up by steering the ray over the screen. The additive combinations of a limited amount of radiation can produce range of colours. The additive colour combination starts in dark adding light to produce colour. The size of the screen is measured diagonally in inches. A colour television screen has a shadow mask with many apertures in it. A computer screen has instead vertical slits that give better resolution and a more stable picture.

Pie chart map is a schematic picture. See *Maps*.

Pie chart or *circle graph*, is a schematic pictures. This group includes: 1) Pie chart. 2) Segmented pie chart, or exploded pie chart. 3) Polar area diagram. 4) Wind rose chart. 5) Ring chart of disk, or multilevel pie chart. See *Diagrams, Minard, Playfair*.

Pieces in a jigsaw puzzle is a schematic picture. See *Metaphorical pictures*.

Pioneer. In my books I have used the word *pioneer* for people who we know by their names. These individuals were working as architects, artists, engineers, graphic designers, mathematicians, painters, photographers, printers, sculptors, statistics, teachers, type designers, typographers, and writers. Many had several professions or skills. See *Predecessor*.

Pisistratus, the first public library, was founded more than 2,500 years ago in Athens. The first bookstore was opened, also in Athens, 140 years later.

Pixel image, or *bit-mapped image*, consists of a large number of small pixels or picture elements, e.g., small squares. These pixels have either a colour (usually black, but they may also be e.g. green or blue, depending on the design of the screen) or no colour at all. All pixels have the same size. Bit-mapped graphics can be modified, stretched, condensed, inverted, rotated, and outlined. Paint-programs are effective multi-purpose drawing tools.

Pixel is a minute rectangular picture element used in “building blocks,” defined by raster coordinates.

Placement of captions. Illustrations in textbooks are often “forgotten” by students as well as teachers. Therefore it is important for editors and information designer to clearly instruct the learners to make use of the pictures. Several authors have noted that a picture should be located as close to the relevant text passage as possible in information and learning materials. It is usually a good idea to put pictures between the appropriate paragraphs in the text to get maximum impact. Pictures that are put within a paragraph will interfere with the reading of the

text. Above the picture, there should be at least one blank line, unless, of course, the picture is not at the top of the page, in which case the upper margin will provide sufficient empty space.

Placement of pictures. People who have not learned to read or write do not necessarily look at pictures in the order that has been intended by the designer. Therefore it often proves helpful, as messages are being tested, to ask several groups of people to arrange the individual message into a sequence that seems most logical to them. This is a way to better get to know the intended audience.

Plain language is clear and succinct writing designed to ensure that the intended readers understand the contents completely and quickly.

Planned communication, *persuasive communication*, comprises studies on advertising, propaganda, and other carefully planned information activities. Here the goal is related to some kind of change in the behaviour of the receivers. Receivers are typically asked to do something. Ads may ask people to vote, go to church or stop smoking, and often the intention is to persuade them to buy a special service or a special product. While advertising presents positive images, propaganda often creates negative images. Propaganda reinforces our prejudices and feelings regarding events, groups of people, or products. In order to influence others, the senders must exchange information, accurately transmit their message and intentions, and identify and understand the habits of the receivers. See *Persuasion design*.

Plano graphic processes. In a pantographic process, or lithography, the image and non-image areas are on the same plane and are distinguished by making use of the principle that grease and water do not mix. There are two different pantographic printing processes. See *Lithography, Offset lithography*.

Plasma screens are flat screens with a network of anodes and cathodes. When the points are made live, a neon-like gas starts glowing. Plasma screens are sharper but require more energy than LCD-screens.

Playfair. Inspired by Joseph Priestley's work with timelines the Scottish engineer and political economist William Playfair (1759–1823) developed the line graph (1786), the bar chart (1786), the pie chart (1801) and the circle graph (1801) to represent economic data. He made the first modern charts in his book *The Commercial and Political Atlas* (1786). See *Priestley*.

Playing-card perspective. See *Overlapping perspective*.

Plotter. A plotter works with one or more exchangeable pens that draw lines, graphs, diagrams, drawings, or pictures in ink in several colours directly on paper or film in different formats. The resolution is normally 50-100 dots per inch. The highest known resolution produced by a plotter is 300 dots per inch. In a flat bed plotter the paper is placed on a plane surface. The prints can often be carried out in large formats. Professional graphic reproduction systems sometimes use so called laser plotters with the possibility of exposing both film and plates in large formats and high resolution, like 2,000 lines per inch.

Pocket-TV. The Japanese electronics company Matsushita in 1983 developed a very compact “pocket television” without a picture tube. The image is 2.4 inches diagonally and built up by liquid crystals. In August 1984 Seiko introduced a pocket colour-television. The image’s diagonal is 2 inches. The set weighs 450 g. The screen consists of a thin film with a transistor in 52,800 individual pixels. The television-image has 32,000 pixels. During 1989 Philips introduced a battery operated 3" colour-television. The screen is built on LCD-technology and has 264 x 384, that is, 101,376 pixels.

Podcasting is a method of distributing multimedia files, such as audio or video programs, over the Internet using syndication feeds, for playback on mobile devices and personal computers. The initial appeal was to allow individuals to distribute their own “radio shows,” but the system quickly became used in a wide variety of other ways, including distribution of school lessons, official and unofficial audio tours of museums, conference meeting alerts and updates, and by police departments to distribute public safety messages.

Point size, type size, is the vertical space allowed for any character of a typeface. See *x-height*.

Point. See *Dots in mathematics, Size of type*.

Pointers. If the lines used as pointers to elements in a picture are heavier than the lines in the picture itself this will create noise and clutter in the illustration. Pointers should be light in comparison with the lines in a picture.

Polar area diagram is a schematic picture. See *Pie charts*.

Political literacy is a set of abilities necessary for citizens to participate in a society's government. It includes an understanding of how government works and of the important issues facing society, as well as the critical thinking skills to evaluate different points of view.

Political literacy is a set of abilities necessary for citizens to participate in a society's government. It includes an understanding of how government works and of the important issues facing society, as well as the critical thinking skills to evaluate different points of view.

Polygon chart is a schematic picture. See *Diagrams*.

Pons in the brain stem, the lower region of the brain, contains circuits for basic movements.

Poor information quality. In the USA, there is an increasing incidence of lawsuits being brought against manufacturers. These lawsuits claim damages as a result of accidents occurring, or products breaking because of poor quality in the language of instruction manuals. The courts are demanding that technical manuals, brochures, information sheets, and labels be written in comprehensible language, and that descriptions and instructions be readable and legible.

Poor legibility. Good legibility is probably always economically advantageous, whereas poor legibility may be a costly business for all parts involved. See *Legibility, Legibility of pictures, Legibility of text*.

Poor picture. See *Poor visual*.

Poor readability. Good readability is probably always economically advantageous, whereas poor readability may be a costly business for all parts involved. See *Readability, Readability of pictures, Readability of text*.

Poor visual. A “poor” visual has a low level of picture quality. It is indistinct and difficult to read. It displays poor legibility and poor reading value. It conveys information poorly, is seldom aesthetically pleasing, and often ambiguous. All kinds of visuals should contain essential information and have a good contrast between figure and ground.

Position of sound. People have a natural ability to isolate sounds in relationship to their approximate positions; behind, above, below, to the sides, or in front of the head.

Positional perspective is based on the fact that objects seem smaller and less distinct the further they are from the viewer. Regardless of distance there is constancy in the perception of the size of known objects (size constancy).

Positive and redundant. A positive and redundant caption will influence our perception of the content in the picture in a positive way

Positive space or *active space* in a visual is the part representing different objects. *Negative space* or *passive space* is the part that is not filled with picture elements. The negative space is usually the background. Space has no meaning in itself, but it may be used to separate or bring together different picture elements.

Post literacy or *Post literacy education* is a concept used in adult and continuing education programs, especially in developing countries. Unlike Continuing education these programs provide skills that might otherwise be provided in primary education.

Poster. The term *poster* was originally used (about 1838) in England to refer to a printed sheet of paper that combined text and illustration. Posters were displayed in public places as announcements, advertisements for everyday articles, or propaganda. No article or product was too simple or too cheap not to be advertised on a poster. The design of these early posters gradually became more ambitious as they began to compete against each other to catch the public's eye for commercial, promotional, or political reasons. Today, we tend to remember the artful and spectacular posters from the end of the 19th century, with advertisements for theatrical performances, cabarets, and restaurants that Chéret, Toulouse-Lautrec, and other artists created. During World War II, the poster became an essential medium for propaganda. In all countries involved in this conflict posters played a major role in the struggle for public support of the war effort. The poster of today is printed with silk-screen-printing or with offset techniques, which makes it possible to use photographs as well. See *Chéret, Educational posters, Toulouse-Lautrec*.

Poster breakthrough. The breakthrough of posters was in the 1830s, as a consequence of the development of the lithographic printing technique. Well-known artists created the black-and-white pictorial posters of the Romantics. At the same time, purely typographical posters were developed, where the

design of letters, words, and texts became very important. The development of chromolithography established the poster as an advertisement medium in the 1840s.

Poster objectives. We can distinguish between 1) Advertising posters, 2) Propaganda posters, and 3) Educational posters. The main objective of advertising and propaganda posters are to deliver a message. A successful poster should instantly grasp the attention of the audience and maintain it until the message has been conveyed. The main objective of an educational poster is to aid learning.

PostScript is a page description language. See *Laser printers*.

Posture is a variable that will influence our perception of individuals in photographs. Individuals are viewed more positively if they are shown walking, running or moving. People standing are viewed more positively than if they are motionless.

PowerPoint, PP, or *Microsoft PowerPoint*, is the name of a commercial slide manager and presentation program developed by Microsoft. It was launched in 1990. It is a competent system for data-projection of text and pictures. In PowerPoint the height-to-width ratio is 1:1.328. The size of the image can be adjusted to the screen. See *Legibility of projected texts, Power Point Presentation*.

PowerPoint presentation, *PPP*. Many business presenters and teachers have replaced their series of overhead transparencies and slides with PP documents, or with similar systems. All illustrations are stored in the Power Point program and pro-

jected with a data-projector. See *Legibility of projected texts, PowerPoint.*

PP. See *PowerPoint.*

PPP. See *Power Point Presentation.*

PQRST. One of the best-known techniques for improving memory from reading is called the PQRST-method (Preview, Question, Read, Self-Recitation, and Test). The method is intended to improve students' abilities to study and remember material presented in textbooks. In the first step, the reader previews the chapter at hand to get an idea of its topics and sections, reading the chapter outlines, the section headings, and the summary. The second, third, and fourth stages apply to each section. Trying to answer questions like what?, who?, when?, where?, how?, and why? will improve learning. An active reader adds structure to the text and summarizes the text with keywords. The fifth step, the test, takes place after finishing the work with the chapter. The PQRST method relies on three basic principles for improving memory: 1) Organizing the material. 2) Elaborating the material. 3) Practising retrieval.

Practical component. See *Combined disciplines.*

Practical disciplines. In practical disciplines students need to develop practical experience and vocationally oriented skills and craftsmanship. They need to work with practical exercises and learn how to execute different tasks in the best economical, practical and safe way. This expertise is often referred as "tacit knowing."

Practical experience. See *Combined disciplines.*

Practical theory. See *Combined disciplines*.

Practice is performance or execution, as opposed to theory; custom or habit; systematic exercise for instruction; training; exercise of a profession.

Practice and theory. Architecture, dance, economics, education, engineering, fine arts, journalism, medicine, music and theatre, and also information design, are all examples of academic disciplines that have a practical as well as a theoretical component. When studying such disciplines it is important for the students to work with theoretical as well as practical assignments. We may see information design as a “theoretical practice” or as a “practical theory.” See *Applied research*.

Practice and use. During the 1990s there was a change in reception analysis from a focus on interpretation and decoding to a greater concern with practice and use. We can see the sender as an “information provider.” In each case the designer may have clear intentions and objectives. However, it is up to the individual “information interpreter” to actively conceive or misconceive the information, to use or not use it, to use or misuse it. This view is especially valid for information sets that people make available to an unknown audience, e.g. on the Internet. Here it is usually not possible to know much about the people who search for, and use the information.

Pragmatic emphasis. Various instructions may influence our perception of the image. This aspect also includes special interests of viewers.

Pragmatic location. The experience of the viewer is needed to resolve ambiguous details.

Pragmatic text parallels. The interpretation of the message by the viewer.

Pragmatic unity. The characteristics of the viewer can work for or against recognition of an image. See *Unity*.

Pragmatics. In linguistics pragmatics is the study of causal and other relations between words and how we connect words to express ourselves correctly. See *Semiotics*.

Pre-attentive processing. A great deal of perceptual organization occurs pre-attentively, not under cognitive control. The way a message is organized, therefore, will have an important effect on the way the perceptual system structures what it detects and, in ways that the perceiver will not be aware of, on how that information is interpreted. The features that are pre-attentively processed can be organised into categories based on colour, form, motion, and spatial position.

Pre-attentively. See *Pre-attentive processing*.

Pre-understanding is vitally important to our perception of any message. The language we choose to use in any given situation is in itself a device conveying pre-understanding. It may be rather hard to bypass pre-understandings and reach to the real or true understanding of a message. When we see a realistic picture on a cover we expect to find an informative real world story content. When we see a cartoon on a cover we expect to find a narrative text and an imaginative content.

Precious Images. Commissioned by the Director's Guild in honour of its 50th anniversary in 1986, the film *Precious Images* was a gift to the American movie audiences. This short consists of a 6.5-minute assemblage of classic moments from 469 favourite movies. Some moments linger for a few seconds but many are as short as eight frames ($\frac{1}{3}$ of a second), averaging 20 frames (less than a second). It is a strange experience to see this film. The carefully chosen images retain their meaning and emotional impact, and trigger your memory. However, in my view you need to see the film several times in order to fully appreciate it.

Precise. Choose your words carefully. Avoid vague and imprecise words. Prefer the direct and concrete to the indirect and abstract. Do not use an abstract noun when a straightforward active verb is better. Do not pile up adjectives or words you want to use adjectivally, in front of a single noun. Avoid three or more nouns in a row.

Predecessor. In my books I have used the word *predecessor* for people who are unknown to us today. In these cases we still have access to the results of some of their work. It may be a painting on the ceiling as well as the walls in a church. See *Pioneer*.

Preference for a particular visual format does not necessarily result in increased learning or increased understanding. Yet, in the absence of more substantial data, information based on student preference has a meaningful role to play in affecting interpretation and learning from information materials and instructional texts. All other things being equal, we should provide

formats that are preferred by the viewer, thus making the text more attractive, and hopefully more motivating.

Prehistory is the period before written history. By studying carvings, drawings, paintings, pottery, sculptures, and other artefacts, archaeologists may recover some information even in the absence of written records. Since the Neolithic period (approximately 10,000–2,000 BC) people have communicated not only through gestures and sounds, but also by means of visual language. Worldwide, hunters and gatherers and later early farmers made use of information systems to advertise services and products. See *Rock art*.

Preliminary messages are physical outlines or sketches used by the originator to explain and demonstrate her or his mental images for the information designer.

Preliminary terms. See *Terminology, Terminology work*.

Preparation, is the second sub-process in the actual writing of a text. The different steps include the making of a preliminary writing plan, study of the subject matter, selection and structuring of all material, and planning for the use of pictures. See *Message design processes, Writing and drawing processes*.

Prepositions. Use the correct preposition for a verb or an expression. If you are not sure which preposition to choose, check in a dictionary.

Prerequisites. The readability, legibility, and reading value of a graphic message are of decisive importance to the receiver's ability to understand the content. Moreover, these factors—besides being influenced by the writing process—are all pre-

requisites for the reading process. The reading value of a message is the receiver's subjective evaluation of the contents of the text and pictures. Another can deem that what is interesting to one person dull. We must therefore adapt text and pictures to be palatable to any given target group. See *Audibility, Distinctness, Legibility, Listening value, Readability and Reading value*.

Presentation design. See *Information design genus*.

Previous experience principle. See *Past experience principle*.

PRI, *Photograph readability index*, refers to the success of the image as defined by its objective or caption. It may be used to evaluate photos in textbooks. The initial phase gathers information on how a viewer perceives a photograph during an initial brief period, that is, at a first glance. The latter phase entails extended exposure to the photograph and endeavours to reveal how a viewer encodes information while being influenced by a caption. Later the PRI utilizes an interdisciplinary battery of methods adapted from the fields of cognitive psychology, linguistics, reading of text, semiotics, and visual literacy.

Priestley. The British scientist Joseph Priestley (1733–1804) was a pioneer in diagram design. In 1765, Priestley published *A Chart of Biography*, a large sheet (about 60x90 cm) with a chart showing the “timelines” for individuals who were important during the interval 1200 BC to 1800 AD. The diagram with an accompanying booklet supplemented his oral lectures in history and general policy. The material consisted of two thousand names. Priestley argued that the diagrams would help students

to see connections between different people and different historical events. See *Playfair*.

Primary colours are red, yellow, and blue; all others can be mixed from these.

Principle of area See. *Area principle*.

Principle of boundary. See *Common region principle*.

Principle of closed forms. See *Common region principle*.

Principle of good continuation. See *Continuity principle*.

Principle of good form. See *Good form principle*.

Principles are based on research findings and cannot be further derived. A *principle* is the basis, the origin, and the fundamental source for development of normative *guidelines*. See *Guidelines, Message design principles*.

Principles for design of business graphics. Graphical information is good in conveying a survey of a situation. When relationships between variables are presented, comparisons of lengths give the best results. When parts of a whole are presented, comparisons of areas can be used as well. Design of graphic elements is important to consider. Most available patterns are probably less good. Patterns should be subdued and not disturbing. Colours like blue, red, and green are liked very much but they do not improve our possibility of reading the message accurately. Different parts in graphic figures should have about the same luminance and radiance. The true differences between areas can be hard to see when shaded differently.

When accuracy is needed, graphical information should be combined with actual figures.

Principles for design of symbols. A specific message may be communicated to the receiver/s or interpreter/s with several different symbols. A specific symbol may be used to communicate several different messages. People can usually not guess the meaning of symbols. People have to learn the meaning of all the important symbols within their own society. A good symbol is clear and simple, and has good contrast in colour, dimension, and form. It can be used in many contexts and in many situations. Graphical symbols may convey generalities of the same order of abstractness as verbal terms.

Principles for design of warnings. All warnings should contain certain elements: A signal word such as “Danger” or “Caution.” A description of the hazard, e.g. in the case of a no diving sign, a statement such as “Shallow water.” A description of consequences that could occur if the person fails to obey the warning’s directions, e.g. “You can be permanently paralysed.” The directions or instructions, i.e., the specific actions that should or should not be done, e.g. “No diving.”

Principles for interface design. Whenever possible the interface should compensate for human limitations. Physical components should be ergonomically designed. The interface should be consistent. Direct manipulation and menus are preferable to command languages. Error messages be concise and simple. It should be possible to “undo” any action. Perform usability testing early in the design process.

Principles for screen displays. Employ general design rules. A screen display may vary with respect to spatial organization like headings, length of lines, justification, spacing, number of columns, number of colours at the same “page,” and directive cues like colour coding, twinkling characters or words, and scrolling text. Colour as well as blank space on a visual display are essentially free and might be used to increase legibility and readability. The best text colour is black, which causes good contrast to most background colours.

Principles for typographic decision-making. We should use typographic space in a consistent way in order to convey the structure of the information. We should use standard page sizes, and grids for pre-planning of pages.

Print literacy. Traditional literacy is sometimes referred to as print literacy. See *Literacy*.

Printers. Several types of printers can print digital computer pictures. See *Colour bubble-jet printers, Dot matrix printers, Ink-jet printers, Laser printers, Phototypesetters, Plotters, Telefax, Telephoto, Thermal printers*.

Printing is the process of producing multiple copies of an original using a printing press. A printing press consists of some means for feeding the paper (or some other material) in contact with an inked image carrier and a system for delivering of the copies. There are four major categories of printing processes: relief, intaglio, the plano graphic process, and screen-printing. In all systems text and pictures are reversed in the printing forms that transfer the printing ink onto the paper, where it ap-

pears in the correct position. See *Electro-press, Relief printing, Intaglio, Plano graphic processes, Screen-printing*.

Printing images. See *Technology for words*.

Printing technology. When Gutenberg died in 1468 ten printers were active in Europe. Then the new printing technology spread rapidly across Europe. Punches and copper matrices became standardized. At the turn of 1500, there were more than one thousand printers in Europe. It became easy to produce texts at relatively low costs and therefore more books were sold than ever before. See *Johann Gutenberg, Technology for pictures, Technology for words*.

Printing text. See *Technology for words*.

Procedural memory, or *implicit memory*, is the memory for skills that are automatic, like driving a car. It is our unconscious memory that is capable of controlling rather complex behaviours. Procedural memory probably develops earlier in life than declarative memory. See *Memory*.

Process colours are magenta, cyan, yellow and black. These are the inks used in four-colour process printing.

Processing. We need to apply and use what we learn. We will remember relevant and meaningful information. Knowledge is internalised, and made our own property as part of our memory.

Processing of colour. In order to facilitate processing of colour the information designer should: 1) Use colour coding in a

consistent way. 2) Limit the number of colour codes. 3) Find out likes or dislikes of colour.

Processing of layout. In order to facilitate processing of layout the information designer should: 1) Use illustrations that are relevant to the content in the text. 2) Make close connections between verbal and visual representations. 3) Avoid inconsistent use of typography.

Processing of pictures. In order to facilitate processing of pictures the information designer should: 1) Use line drawings when study time is limited. 2) Provide more realistic versions of artwork when unlimited study time is allowed. 3) Use graphics in a consistent way.

Processing of text. In order to facilitate processing of text the information designer should: 1) Design text to facilitate mental processing. 2) Use a variety of examples and non-examples. 3) Provide the time that is necessary for the receivers to read, interpret and understand the message in the text.

Product design is a systematic way to create ideas, and develop new products. Product designers will use digital tools to analyze, design and visualize the new products.

Product visualization involves software technology for manipulation of 3D models, simulations, technical drawings and other kinds of documentation. Images have high levels of photorealism and can be used in design, marketing, and sales. See *Technical visualization, Visualization*.

Production of draft. The subject matter experts produce the basis of the very first “raw” draft (sometimes simple sketches),

from which the subject matter experts, technical writers, and graphics editors may produce a first draft with outlines for the pictures. Here we can note the following six steps: 1) Establish a system for control of the various versions of the documents. Use a document numbering system. 2) Study the raw draft. Work with text design. Write the text. Create and use standard templates. Use only one word processing system within the project. 3) Study the raw draft and the text. Work with image design. Draw simple sketches with explanations for drawings and photographs. 4) Organize interplay between text and pictures. 5) Prepare work with typography and layout. Bring any last-minute ideas into the process. Prepare the preliminary manuscript. 6) A subject matter review will ensure that the content is correct and relevant to the intended audience. A pedagogical review will ensure that the material is well structured and comprehensible. The information material must also be highly legible and readable, and have a high reading value. When possible members of the group of intended users should be asked to review the draft. See *Message design processes*.

Production of message commences with an idea occurring to someone or with the need to convey information to a given target group. When an outline is ready, the generation of text, draft sketches, editing, graphic design, the production of originals, masters and, ultimately, a given quantity then begin. The sender produces a representation of reality. A representation is a medium with specific contents, i.e. a message. Other tasks for the sender are stockkeeping, distribution, marketing, advertising, selling, billing, bookkeeping etc. Regardless of the specific objectives it is important to secure quality in any information

and learning material. This must be included in the processes for production.

Production of original and master. Before the original can be confirmed as the master, where the text and the visuals finally are brought together, there should be an overall final check according to the following steps: 1) *Versions*. Make sure that the final versions of the various parts of the documents are used for the originals. 2) *Text*. Check the quality of the technical production. 3) *Drawings*. Check the quality of the technical production. 4) *Photographs*. Check the quality of the technical production. 5) *Graphic design*. Check the quality of the technical production. 6) *Corrections*. Correct any errors. See *Message design processes*.

Production of script. All necessary work on the text and on the schematic pictures as well as ideas for important photographs arising from the comments made by the reviewers should be incorporated in the information material in this phase, the production of the script. When the script is ready the information material looks like a completed information or learning material. We can note the following steps: 1) *Versions*. Control the versions of the document. 2) *Text*. Edit the manuscript into its final version. 3) *Drawings*. Order or produce the originals based on previous sketches. 4) *Photographs*. Produce prints that are suitable for reproduction in accordance with previously made sketches or test shots. 5) *Graphic design*. Work with typography and layout. 6) *Reviews*. Review the verbal and visual materials. 7) *Copyright*. Check copyright clearance for all materials before the technical production may start. This may save a lot of trouble later on. See *Message design processes*.

Production processes. The sender's production processes are influenced by production principles, and are performed with various tools for production. Production principles can be seen as a set of guidelines for production of any message. All processes should include suitable quality reviews and quality controls.

Production techniques refer to the manner in which different kinds of information materials and information products are produced. Historical aspects and the evolution from rather primitive methods to more advanced production techniques can be studied for most groups of information materials. Production techniques are closely related to media. Production techniques have made rapid advances in recent years. Computers are being used to an ever increasing degree in conjunction with the production of different media. Once data have been stored in digital form, they can be easily presented in a manner tailored to the optimum conditions for different media.

Products. Traditionally publishers and booksellers have been working with books. Regardless of the content, fiction or non-fiction, the book is a physical product. However, products are now gradually replaced by "content-services," that is, services to give people the entertainment, the information, the knowledge, or the news they want to have in different situations. The constant development of new technology and new media presents producers with exciting new options. To be successful the sender has to know about various media and their unique possibilities. The information designer has to utilize media advantages, and avoid media disadvantages.

Professional communication is an umbrella term for the creative activities that adults engage in as they compose purpose-driven communications on the job. It encompasses the range of advanced writing and visual design activity in workplace settings and includes information, instructions, manuals, presentations, and proposals, reports etcetera.

Professional communicators possess rich schematic and tacit knowledge about genres, processes, stakeholders, symbols, and tools. They are visually and verbally fluent and draw on a large repertory of semiotic resources (words, images, sounds, numbers). Professional communicators are able to *read the context* and scope out cultural and social resources. They are noticing opportunities that can enable them to exert change. See *Cultural skills, Knowledge skills, Rhetorical skills, Social skills*.

Professional markets have restricted and selective applications and specialized subject areas. Services are likely to grow out of existing requirements in answer to specific needs and will include provisions of specialist information and data, fast updating, current awareness, software packages, complex information retrieval, and research dissemination. The services may be provided by commercial umbrella information providers, professional organizations, or commercial publishers, and are likely to be mounted on host computers accessible via telecommunication networks, or supplied on portable machinereadable files such as tapes and discs.

Professional roles. An information designer is to a large extent a project manager who coordinates work on text, images and graphic design. See *Occupational roles*.

Profile rules involves the organisation's a carefully thought-out programme for its graphic profile, including name and logo, address, number of pages, the date, the type of document, the author, the approving party, the examiner, the version, the degree of confidentiality and the subject. Ready-to-use templates save considerable time and contribute to the creation of a distinct and uniform structure for documentation and to a uniform identity for an organisation.

Program of Systematic Evaluation. The *PSE* was initiated in 1965 by professor Francis Dwyer at Penn State University in the USA. Dwyer wanted to identify visual materials that are effective in facilitating student achievement of different educational objectives. More than 50,000 high school, college, and adult learners have participated in more than 200 visual research studies. Continuity was maintained by utilizing the same 2,000 word instructional unit on the human heart. Visuals range from simple line drawings to realistic photographs, in black and white as well as in colour. A variety of presentation formats, such as booklets, television, and slide-audiotape presentations have been used. Test formats exist in both verbal and visual versions. Students' knowledge of specific facts was measured with a terminology test. An identification test measured students' ability to identify positions of the different parts within the heart. Students' ability to reproduce the parts of the heart in their correct contexts was measured with a drawing test. A comprehension test measured the students' total under-

standing of the function of the heart. It was found that visual testing is a valid strategy for assessing students' learning from visualized instruction.

Programmed learning involves gradually increasing the level of difficulty while continuously reinforcing correct responses and extinguishing incorrect responses. Programmed learning has demonstrated its effectiveness in education, although it has not lived up to its early promise.

Prohibitions is a term for a group of information materials in the category *Brief messages*. A prohibition is a regulation stipulating something that must not occur or be done, often because of the risk of injury to people or property damage. A prohibition may be impressed or printed on different products, such as machinery, signs and fences, in the form of words, letters or symbols. Trespassing on private property, diving from a trampoline, entering a construction site, camping, various activities in traffic etc. are examples of prohibitions.

Project manager is responsible for the project budget, for coordinating and controlling the whole project, and for reporting to the management and to other control groups. The project manager may be a skilled information designer, an infographer.

Project secretary is responsible for maintaining continuous contact between the different sub-projects, for writing minutes from meetings, and for the final delivery of the completed information material.

Project website. The most important function of a website place for a project is the file archive. It enables all members of

the project to share and access important information and research results. Since the file archive is most important it has shown to be a good solution to make that the central part of the project place website. Additional features can then be designed as complements to this central feature.

Projected typography. In audio-visual instruction and in audio-visual materials, such as overhead transparencies, slides, filmstrips, and computer-based presentations, lettering must be considered carefully in order to improve legibility. Type must be large as well as bold enough to see. In verbal presentations, many of the projected images consist only of text. In written documentation, this type of information should be worked into the body of text instead.

Promotional literacy is the aspect of advertising literacy that helps consumers weigh and evaluate the commercial forms, functions and objectives of media in general.

Pronouns. The relative pronoun *which* refers only to things, *who* refers only to persons, and *that* to either persons or things. Pronouns (*it, they*) and the pronominal adjectives (*its, theirs*) cannot be orphans; they must always have a parent noun close by. You will confuse the readers if you talk about *it* without revealing until later what *it* represents. When writing technical English repeat the important terms to avoid uncertainty.

Propaganda. Messages are often promulgated in a highly insidious fashion. Pictures can have a subconscious impact on people's emotions. Then content is never critically analysed nor processed. It is sometimes difficult for people to shield themselves against propaganda messages, especially when the mes-

sages are frequently repeated. If a message is repeated often enough, we may lose our ability to be critical and analytical about it. Certain kinds of propaganda can be included in the concept “information material.” Many paintings in medieval churches and the design of church buildings, castles and manor houses, can be included in this category. Art and lavish buildings currently convey a clear message about power and influence. See *Advertising, Persuasion design*.

Propaganda objectives. The objective of propaganda is to disseminate an idea, an opinion or a philosophy. The idea is for the receiver to imitate, emulate or mimic, and intentionally try to resemble someone else, become convinced of something, behave in a particular way, adopt a particular attitude or buy a product or an idea. Propaganda often creates negative images and reinforces our prejudices and feelings regarding events, groups of people, or products.

Properties of verbal language. Verbal languages have digital coding using combinations of letters (including numerals) to represent content. There is no direct correspondence between groups of letters, words, and reality. Each meaning is defined and must be learned. Verbal languages have varying levels of meaning: 1) phonemes (without meaning), 2) morphemes (with meaning), 3) syntagms, sub-meanings, and 4) complete meanings. A written text can convey information, contain analyses and describe feelings and facts. It is more likely that graphically complex texts will be read than “plain” texts. It takes less time to read a graphically complex text than a “plain” text. To describe the properties of text, linguists work with advanced text analysis. Over 200 readability formulas exist.

Properties of visual language. Variables in visual language have functional as well as suggestive properties. The functional properties are related to cognitive factual information in content, execution, context, and format. The suggestive properties are related to emotions, conceptions, aesthetic perception, tension, fright, etc. See *Functional properties, Suggestive properties*.

Proportionally spaced type. Most typefaces are proportionally spaced. Then different letters are assigned different spacing in accordance with their individual sizes and shapes. However, on most typewriters and some printers the typefaces are monospaced. In such typefaces all the letters have the same amount of space. The letter “i” takes the same space as the letter “m”. Proportionally spaced type is usually easier to read than monospaced type.

Proto-writing. The early writing systems were based on earlier traditions called proto-writing. These systems used ideograms, pictograms, and other early mnemonic symbols. Proto-writing systems emerged about nine thousand years ago. It is generally argued that proto-writing lacked the ability to express ideas and thoughts.

Providing clarity. The *legibility of a graphic message* is determined by the technical design of texts and pictures, that is, their *clarity*. The information designer will have to make the content stand out clearly from the background. Generally speaking information and learning materials should be as clear, simple, transparent, and unambiguous as possible. We should avoid unusual typefaces, as well as fonts that are too small or

too large. We read words in a text as “word pictures,” not letter by letter. Typeface and font size must be adapted to meet the limitations of the medium and the technical production. See *Legibility*.

Providing emphasis. The most important elements in information material may be emphasized to enhance attention and perception. A dark dot in a light field and a jog in a straight line are two good examples of emphasis. Emphasis may be used to *attract*, *direct* and to *keep* attention. Typography and layout will better show the structure and the hierarchy of the content in the information material when important parts are emphasised. It is possible to provide emphasis in information material with the help of a number of specific design elements. Generally speaking highlighting cues and emphasis in a message will result in attention to that message. We should, however, never overuse any accenting techniques because if we do they may completely lose their meanings and their power to emphasize.

Providing simplicity. Readability is determined by how well the presentation of a message is adapted to the readers. It involves the reader's ability to understand the style of text, the pictures and graphic form. The choice of words, symbols, and picture elements creates the style. There is a close relationship between guidelines that are aimed at providing *simplicity* and guidelines that are aimed at *facilitating perception, processing and memory*. Simplicity in a message will result in easier and more efficient perception, processing and memory of that message. Providing simplicity in text, illustrations, and graphic form is probably one of the most important principles in information design. (See *Readability*.)

Providing structure. A clear and obvious structure will facilitate perception, interpretation, understanding, learning and memory of the message content. *Colour* can clarify the structure of a text. Certain parts of the text may be printed with colours or printed on top of backgrounds in different colours. The use of colour should be *consistent*. Clear *headings* make the subject matter readily apparent and aid comprehension of the text. Placement and space enhance the hierarchic structure. The *level of detail* should be decided early in the process. Subject matter experts often spend far too much time and effort describing details. A legible *list of contents* shows the reader an overview of the contents. *Verbal messages* work well when the content of the message is analytical, detailed, logical, narrative, theoretical, and sequential. *Visual messages* are preferred when content is emotional, holistic, immediate, spatial and visual. For complex messages combined verbal and visual representations may be the best choice. Layout and *typographic variation* provides a large number of possibilities to make the structure clear.

Providing unity. Information materials should have unity, an “overall coherence and togetherness.” Inconsistencies may confuse the receivers. Use style, and terminology in a consistent way in each specific information material. Use pictures, layout and typography in a consistent way. Use accenting techniques in a consistent way. See *Unity*.

Proximity principle. The proximity principle is also known as the law of proximity. We will perceptually group events, objects, and units on the basis of their proximity to one another. Elements that are close together are perceptually grouped together, all other things being equal. They “belong together” and

they are processed together. The need to process large numbers of small stimuli is reduced, and perception is faster. Elements that are far apart are perceived as separate objects. Spatial proximity is one of the most powerful organizing principles and one of the most useful in information design for facilitating perceptual organisation of data. We can use space to group graphic components. Related data should be put in close proximity to each other in lists and in tables.

Prägnanz. See Good form principle.

PSE. >*Program of Systematic Evaluation.*

Psychological information theory is the designation for one of the main branches of cognitive psychology. It refers to the study of man's mental information processing of text, pictures and other representations. A major principle is that man organizes impressions and knowledge into meaningful units. This process starts with attention and perception. Psychological information theory describes the cognitive processes in the brain as a flow of information between different memory functions.

Psychological perspectives are visualisations of psychological, subjective values. It includes *imaginary perspective*, *simultaneous perspective*, and *value perspective*.

Psychomotor skill. See *Perceptual motor-skill*.

pts. Pica points. See *Size of type*.

Public literacy. Traditional literacy is sometimes referred to as public literacy. See *Literacy*.

Publishing. Transmitting a message from an author to the readers requires people such as text and picture editors, graphic designers, typesetters, repro technicians, printers, bookbinders, stockroom staff, salespersons, order takers, bookstore employees, librarians, buyers, and administrators. The different steps involved in publishing are still time-consuming and jointly represent a major expense. About ten percent of the price of a book, not including tax, usually goes to the author. Electronic publishing may change this situation to some extent. That would reduce the distance between authors and readers. New opportunities for a dialogue might then develop in some instances.

Punctuation. See *Colon, Commas, Full stops, Hyphens, Semicolon.*

Purpose. The purpose of an intended message may be advertising of a product or a service, providing a business proposal; providing education, entertainment, information, instruction, learning, training, establishing a change of behaviour, making a decision, performing an action of any kind, or any combination of these and many other examples.

Purpose of graphic design. The purpose of work with graphic design is to find a *suitable presentation of the message* with respect to the intended receiver, medium, and economical situation. A well-designed book appears as a "unified whole." All design elements serve to enhance the content.

Purposes of illustrations. See *Image functions.*

Purpose of photo is a variable that will influence our perception of individuals in photographs. The purpose of a photo is important for our perception of the person depicted.

Purpose of reading. We read in different ways, depending on the purpose of our reading. We read intensively, every word and line, when our purpose demands it. We skim if we only wish to quickly get some idea of the material. We read to orient ourselves if we want to know where some particular information is to be found in a text. We read to inform ourselves when we need certain limited information. In each of these cases, we leave out anything that does not satisfy the purpose of our reading directly. Different reading objectives or purposes attached to reading give rise, therefore, to different reading purposes. These purposes differ in terms of the level of text on which the reader focuses, and in terms of how the material is processed.

Q

Quality. A good information material have a distinct structure, is relevant, legible and readable for the intended audience. The intended audience should have the final say about the content, illustrations and sequences that are used in any information material. Administrators and others indirectly connected with the project usually will have an abundance of suggestions for revision, or state that they do not understand the message. But, the materials were not designed for this group.

Different information materials may have multiple functions and more than one objective all at the same time. Good information materials make everyday life easier for receivers who need the specific information and provide senders with a good economic return and good credibility. In information design the content of the message is more important than its context, execution, and format.

Data and facts must be correct and also relevant to the situation. The information designer should: 1) Establish a system for control of the different versions of documents. 2) Review the information material with respect to credibility, graphic design, structure, style, and terminology before technical production. 3) Invite users to evaluate the information material. See *Information quality, Technical quality*.

Quality of language. The way in which good quality of language is defined is, to some extent, dependent upon the purpose of the text. Technical writers, for example, are more consciously concentrated on getting results than other writers. Because technical language must be capable of effectively conveying as much information as possible to a certain group of readers, it is

characterised in its ideal form by brevity, clarity and precision. To describe the properties of text, the linguist works with advanced text analysis. However, it is relatively easy to describe a text's readability by using a readability index, a character index, and a nominal quotient. There are several different subheadings under the general heading "quality of language," among them, phonology, morphology, syntax, style, pragmatics and infology.

Quality of papers. The quality of individual papers in information design may be quite different. Since everything is new there are no systems for peer reviews. As a result some of the papers may only have a very limited value. But, again, not many people will be able to read these papers. When a group of people with similar research interests meet, one of them may come up with the idea of organizing a meeting, a seminar or even a conference. This may be the beginning of a "special interest group," a "SIG," within an already existing organization. It may also, in fact, be the beginning of a new organization. When this group of people decide to study a common theme and present their findings at a future meeting they suddenly introduce a very strong way to boost research in this specific and selected area.

Quantitative data should be made to stand out from the supporting information (like grids) by ensuring that the different items on a graph can be easily distinguished visually.

Quantitative perception. The reader must be able to determine the amount of difference between ordered visual elements. It is easy to estimate the difference in length between lines. However, it is hard to compare areas and even more difficult to compare volumes.

Quantity diagrams are a kind of diagram with totality and subsets. See *Diagrams*.

Questions. Trying to answer questions like what?, who?, when?, where?, how?, and why? improve learning. An active reader adds structure to the text and summarizes the text with keywords. The fifth step, the test, takes place after finishing the work with the chapter. The PQRS method relies on three basic principles for improving memory: 1) Organizing the material. 2) Elaborating the material. 3) Practising retrieval.

Quotation marks, ‘ ’ “ ” « », are used according to different standards in different languages.

Quotations. Sometimes quotations are included in a text. Short quotations can be integrated into the body text, but long quotations should be distinctly separated from the rest of the text. Quotations are often indented, sometimes also on the right side. Any quotation that is used must have the source of reference cited, in keeping with common rules of writing.

R

Radiance is a radiometric measure of light emitted by a surface (watt/steradian/sq.m). Different parts in graphic figures should have about the same radiance. The true differences between areas can be hard to see when shaded differently.

Radio listeners sometimes have great difficulties in comprehending broadcasted news.

Raised initial letters. See *Initial letters*.

Raster-dots are employed in the printing of pictures. The number of raster-dots will define the quality of the final printed image.

Readability. Originally the concept *readability* stems from education research concerned selection of reading material for children of different age groups. What makes a message difficult to read is not as often the subject matter as the style. The choice of words, symbols, and picture elements creates the style. Today readability of a message involves the reader's ability to understand the style of graphic form, pictures and text. See *Index of readability, Information costs, Readability of colour, Readability of layout, Readability of maps, Readability of numerical values, Readability of pictures, Readability of print media, Readability of projected texts, Readability of symbols, Readability of text on screens, Readability of text on wall charts, Readability of text, Readability research*.

Readability of colour. When colours of equal intensity are compared the most visible hues are white, yellow, and green—in that order. The least visible hues are red, blue, and violet. Yel-

low is a powerful colour because of its luminosity. It is especially powerful when combined with black. See *Anomalies of colour vision*.

Colour coding improves attention, learner motivation, and memory. Subjects dislike the use of more than three or four text colours on the same page, screen, or slide. For some learners and for some educational objectives, colour improves the achievement of the learners. However, in some cases the added cost of colour may not be justified.

Female and male subjects show no differences in reading efforts of different colour combinations.

Graphic symbols often have bright colours to intensify their meaning. Here common hues are pure yellow, red, blue, green, white and black, or combinations of these. Complementary colours contrast, and they provide a warm–cool effect.

Traffic signs. Unfortunately, red and green are quite often used as discriminating colours in symbols and in warning signs. Many colour-blind people perceive red and green as grey. Colour may be combined with shape, and position, or with both, which is often seen in traffic signs. See *Readability*.

Readability of layout. The style of the graphic form is decided by the specific choices of typefaces for headings, running text, captions, and also the use of justification, number and placement of columns, number and placement of pictures and tables, the use of colour cues, et cetera. All informative layouts must have good readability. See *Readability*.

Readability of maps. Symbols are of special importance and value in maps. However, symbols have to be learned by the readers. The way in which visual variables are combined has

greater importance than how the variables are comprehended. Using too many visual variables at the same time makes map reading more difficult. When several variables are used simultaneously the hierarchy of visibility is important. The largest symbols are perceived first. *Size is more important than colour and form.* See *Readability*.

Readability of numerical data. Numerical data can be presented in tables and in graphs. Items within columns should be grouped and separated from other groups by either white space or by rules (lines) in order to facilitate reading without accidentally moving to another row. Groups should contain no more than five items. Redundant abbreviations of units should not be included within the table entries (although they should be included in the column or row headings). Whenever possible, columns should be arranged so that the target entries are to the left of the answers. Numbers should be rounded off to no more than two significant figures. Averages of rows and columns (as appropriate) should be given to facilitate comparisons of individual cell entries. Put the most important comparisons into columns (rather than rows), as columns make for the easiest comparisons. Numbers in rows or columns should be arranged in some meaningful order whenever possible (e.g., increasing or decreasing). See *Readability*.

Readability of pictures is the ability to understand visual messages. The *style of illustration* is decided by the specific choice of drawings, photographs, schematic pictures, as well as consistency, expressions, picture elements, and symbols. Images can be readable in the sense that they inspire affective and cognitive processing. A drawing style that includes different

kinds of lines, patterns, shadings, and inconsistent use of symbols may obstruct the reading and understanding of the picture content. Readability of pictures is governed by the functional properties of picture variables. *Instructional illustrations* have good readability when the subject matter and pictorial conventions are familiar to the audience and depicted in a realistic manner in illustrations lacking excessive image detail that may distract from the main message. See *Readability*.

Readability of print media. Active, affirmative, clear, declarative, essential and short words in simple, short and precise sentences are the most readable. Readers prefer small text paragraphs to big ones. Often it is quite easy to divide the text in hierarchic and natural parts, portions, or sections. Natural breaks emphasized by typography are helpful. Providing “white space” between portions of the text provides cues to the learners that a new section or a new type of activity follows. The end of a sentence should be determined by syntax rather than by a set width of a line. The structure of text should be as clear as possible. See *Readability, Style guides*.

Readability of projected texts. Many speakers mainly use text transparencies, or “word visuals,” containing key words in attempting to supply an overview, clarify, reinforce, and summarize complicated arguments. Text must be bold enough, and large enough. We should not display frames longer than it takes to explain the contents. Always restrict the number of words. Text transparencies are useful for the speaker but may be very boring to the audience. It is also very boring when there simply are too many spelling mistakes. Check the spelling once more. It is a good idea to put the necessary identifications data on each

transparency, each slide and each computer file. See *Overhead transparencies, PowerPoint presentations, Readability*.

Readability of symbols. Many symbols are culturally biased and thus arbitrary to those from other cultures. People have to learn the meaning of the important symbols within their own society. A good symbol is designed so it can be used in many different situations and in many contexts. See *Readability, Readability of colour, Warning signs, Warnings*.

Readability of text. Readability of text refers to the ease of understanding due to the construction of the text, including the length of words, sentences, paragraphs and the style of writing. For text the linguistic usage as well as the style should be correct to avoid distracting the readers. The style of text is decided by the specific choice of words, consistency, and expressions. Simple, active, affirmative, and declarative sentences are the most readable. Abstract words, jargon, long and complex sentences, passive constructions, and stilted language may obstruct reading and understanding of the text content. Furthermore readability refers to the reader's reading skill and interest and how easy it is to read long passages of text. See *Index of readability, Readability*.

Readability of text on screens. General design rules should be employed also in the design of text on screen displays. These guidelines are similar to those for readability of text on wall charts and readability of projected texts. Design may vary with respect to headings, length of lines, justification, spacing and number of columns. Colour as well as blank space on a visual display are essentially free and might be used to increase legi-

bility and readability. All capital letters, *caps*, are harder to read than a “normal” combination of upper and lower case letters. Words become difficult to read which will reduce the speed of reading. See *Readability*.

Readability of text on wall charts. A wall chart must have good readability. General design rules should be employed also in the design of text on wall charts. These guidelines are similar to those for readability of text on screens and readability of projected texts. Wall charts used to be a fine complement to textbooks. During the 20th century filmstrips, slides, overhead transparencies superseded wall charts. Later computer assisted presentations superseded these AV-media. Compared with traditional graphic presentations, a presentation of information on wall charts is very limited. Usually people are not willing to read long text passages. See *Readability*.

Readability research has been directed towards finding the characteristics that make texts easy or difficult to understand. Long words and long sentences make a text difficult to read. The number of words in a sentence appears to exert the strongest effect on reading rate and reading comprehension.

Reader slides, word visuals. Many speakers use projected images containing key words in attempting to supply an overview, clarify, reinforce, and summarize complicated arguments. See *Legibility of projected texts, Overhead transparencies, PowerPoint presentations*.

Reader’s text is different from the writer’s text. See *Text structures*.

Reading is a language-related activity performed by the receiver. Most people read instructional materials selectively. Readers rarely, if ever, begin at the beginning and read straight through to the end of a document. Usually we use a combination of browsing, reading headings, looking at illustrations, reading captions, reading certain parts carefully, skimming others, and avoiding some parts completely. See *Emphasis in layout*, *Reading objectives*, *Reading session*, *Reading value*.

Reading objectives. Reading is a very important means of learning about our environment. The more a person reads, the more the reading skills improve. Depending on the purpose, we can read a text in several ways. An active reader makes good use of the structure embedded in the book and in the text. The preface, the table of contents, the headings, as well as the captions and the illustrations provide an overview of the content in the whole book.

Reading session. We best remember what we read at the beginning and at the end of a reading session. The optimum time for learning from reading seems to be 20-40 minutes. We will forget most of what we learn if we do not rehearse the material. After finishing reading, it is time for the first rehearsal, reading keywords and notes. It is a good idea to repeat this after a day, after a week, and after a month.

Reading value. The message should be well worth reading. This designates the properties of the content of a message and is very subjectively dependent on the reader's degree of interest in the message. Each group of readers selects information material on the basis of her or his personal preferences. What is interest-

ing for one person may be perceived as boring by another person. The same message may be interesting at one instance but uninteresting at another occasion. Studies of readability have resulted in lists with reading suggestions for various age groups.

Realism. A visual should usually possess a moderate and selected degree of realism. Too little or too much realism can interfere with the communication and learning processes. A visual should contain the details that are essential in communicating the intended message. Too many details reduce the interest for the content. Too few details make it impossible to understand the picture. A series of slides could be a better choice than a film in a specific learning situation. In addition, a few slides cost only a fraction of the cost of producing a film.

Learners being exposed to “new” information may profit optimally from simple line drawings, whereas learners who are familiar with the content area may profit from more realistic types of illustrations like photographs. A wide variety of examples and non-examples enhance concept learning. Critical attributes should show as little variation and be as obvious and typical as possible. Non-critical attributes should show much variation and be as non-obvious and non-typical as possible. For entertainment and leisure, representations close to reality might be good choices. For instance, it could be exciting to “walk around” among the actors in a holographic film in stereo sound and in realistic colour. See *Complexity*.

Realism theories. The “realism theories” include the iconicity theory. The basic assumption is that learning will be more complete as the number of cues in the learning situation increases.

Realistic art styles are photographic style and representational style. Children equate highly realistic art styles (photographic and representational) with text content that depict reality and real-life situations.

Realistic pictures. Pictures are always related in some way to reality. But they must never be confused with reality and are incapable of replacing reality. Objective documentation of a course of events, a product, a situation, by means of documentary drawings, electronic pictures, photographs, radiographs, satellite photographs, thermographic pictures, ultra sonograms and X-rays is often necessary. These pictures are frequently *realistic* and simulate reality in ways unique to each documentation process. However, apparently objective documentation can occasionally be extremely subjective and suggestive when the choice of images, the cropping, layout, and contents of captions are overtly selective.

Receiver. The receiver of an intended message may be business partners, colleagues, dentists, employees, course participants, ministers, students, teachers, veterinary surgeons, retired professors, teenage girls, teenage boys, or a “general” audience—just to mention a few. There are of course many more groups of receivers. It is obvious that a person may belong to several groups of receivers, or “target groups.” There are always individual differences among members of any group. See *Receiver activities, Receiver groups, Receiver principles, Receiver processes, Receiver response processes, Receiver selection processes.*

Receiver activities. In the receiving of a verbal and visual message, the receiver will use several processes and reception tools. The processes are influenced by reception principles. All receiver processes are influenced by prior experience in relation to age and gender, as well as by cultural, economical, historical, political, religious, and social factors. Such experiences will influence the selection processes, the mental processes, and the response processes. The influence of these factors has a major impact on how receivers relate to messages of different kinds, and on how meaning is constructed.

Receiver groups. The intended receivers of a message are sometimes referred to as audiences, demographic groups, information interpreters, target groups, target populations, and users. In extreme instances, some intended groups of receivers only consist of one or two individuals. Other groups, like a “general audience,” may at the same time encompass millions of people. However, most target groups are somewhere in between these extremes, but certainly a lot closer to the lower end of the continuum. The smaller a group of receivers is, the greater our ability is to describe it in a reasonable fashion. More individual characteristics are manifested in large groups. The more information we have on a particular group, the greater our ability is to address this group in such a way that our messages are understood.

Receiver principles. There are literally many thousands of possible groups of receivers. Therefore it is important for the information designer to: 1) Carefully define the group of intended receivers. 2) Collect data about age, culture, gender, and socio-

economic factors. 3) When possible, consider any feedback that may be expressed by any previous receivers.

Receiver processes include search and selection of information, and mental processing of information. When a message is internalized the receiver has got new emotions, new experiences, new feelings, and new knowledge. Often individuals will interpret the same representation in different ways. Here age and gender, cultural, economic, historical, political, religious, and social factors may be important. The internalized message will influence the interpretation and understanding of future and related messages. Principles related to receiver processes include attention, perception, learning, and memory. In perceiving a message the receiver uses sensory organs and the nervous system. Tools related to receiver processes include catalogues, directories, databases, indexes, and libraries of different kinds.

Receiver response processes. Response principles include rules and guidelines, standards, and values. Response processes include application of knowledge, change of behaviour, and change of emotional status such as anger, disgust, fear, happiness, sadness, and surprise. In some situations it may be possible for the receivers to provide the sender with feedback. This feedback may be of great value for the sender when updating the information material. However, in many situations it is not at all possible for the individual to give any feedback to the sender. Response tools include body language, verbal language, and visual language.

Receiver selection processes. Selection principles include areas such as a critical view and a natural suspiciousness with respect to the sender and the purpose of the message, an understanding of the role of media in society, available time, costs, credibility, cultural factors, ease of use, individual interests, language, personal needs, reading value, and socio-economic factors. The receiver should always be keen to question what the artist, author, editorial staff, photographer, intends with a message.

Recipes is a term for a group of information materials in the category *Instructions*. An increasing number of raw materials and semi-manufactured products are supplied with information on the contents inside packaging and ways to prepare those contents. This obviously applies to directions on preparing various dishes but also includes different kinds of chemical products, such as commercial fertiliser and insecticides. Recipes and instructions on how to prepare food are frequent features in weeklies, cookery-books and TV shows.

Recognition of words in continuous speech is far superior to our ability to recognize them when they have been isolated. We use contextual information in recognizing what we hear.

Rectilinear decorations of Neolithic rock carvings are straight: 1) chevrons (inverted V-shaped patterns) or zigzags, 2) lozenges or diamonds, 3) offsets or comb-devices, 4) parallel lines, and 5) radials or star shapes.

Reduction through successive refinement is the best way to reach clarity. To create an elegant solution, anything that is not essential to the communication task has to be removed.

Redundancy/information line. A picture creator who is very familiar with her/his target group can easily ensure that redundancy/information in a picture is on a level relevant to the picture's aim. The redundancy factor provides the picture creator with an opportunity to relate viewer perceptions to picture contents.

Redundant relationship should be used in instructional message design. Similar information is conveyed via words, sound, and visuals. For example, subtitles can be added to a television programme, so that the action displayed on the screen is described by words. This greatly enhances the educational impact of the programme. The justification for using redundant information in print or oral (or both) and visual channels is to provide the learner with the opportunity to receive information alternatively from either channel, and to help the person short-circuit any dependence on printed or oral instruction (or both). Properly used educational technology can drastically reduce the time it takes to create meaningful knowledge out of information. See *Modality*.

Reference list. References to cited works are usually put in a *reference list*, or a *bibliography*, at the end of a chapter or at the end of a book. Write references in accordance with one of the international conventions. Reference lists are often voluminous and may take up a great deal of space. Since the reader will usually peruse such a list to find only certain entries, they should be made easy to find. Therefore, the text should be distinct even though it is relatively compact.

Referent. See *Sign*.

Regulated search. Regulated and restricted search was the first type of search to be used in any database system. One classical example is databases containing bibliographic information about articles and books). These systems require the use of precisely stated search strings. A search string may be the name of author, the title of book, the name of publisher, an address, etc. If we search for one of my books and write my name as “Rune Pettersson” we will not be able to find books listed as “Pettersson, Rune.” Here the order of the names is important. Usually, there are also severe limitations on the number of fields which can be searched for, and also the number of characters in each field. Each search object has to be specified exactly in the correct field.

Regulations. See *Design motto*.

Relationships between elements in information material can be contradictory, irrelevant, redundant, and relevant. When relationships between variables in a graphic are presented, comparisons of lengths give the best results. See *Contradictory relationship, Irrelevant relationship, Modality, Redundant relationship, Relevant relationship*.

Relevant relationship. The information presented via a text or sound supplements the information supplied in the visual. Visuals with relevant relationships to a spoken or printed text can greatly enhance the text’s informative effect, and vice versa. See *Modality*.

Relief printing. In relief printing the printing areas are raised above the nonprinting areas, and the impression is made directly from the inked raised surface to the paper. There are sev-

eral relief printing technologies. See *Flexography*, *Letterpress*, *Wood engraving*, *Woodcut*.

Renaissance. In European history the Renaissance represents a cultural rebirth from the 14th through the middle of the 17th centuries. It was a cultural movement beginning in Italy and slowly spreading to the rest of Europe. The main theme of the Renaissance was the renewal of antiquity. Several pioneers made remarkable achievements related to verbal and visual information. See *Donatello*, *Filippo Brunelleschi*,

Renaissance perspective is a one-point perspective. All lines vanish in a single point in the picture. See *Central perspective*.

Rendering technologies aim to give screen text the clarity of printed text.

Reports is a term for a group of information materials in the category *Factual information*. The purpose of reports is often to help the receiver understand, i.e. to absorb conceptual concepts in reports and form an understanding. Understanding more or less complex relationships, comparing different alternatives with one another and reaching her/his own conclusions about the way to act in other situations are examples of what is involved. Reports are formal accounts of studies and completed assignments. Examples in the information field or themes for reports are: conference reports, final reports, financial reports, such as final accounts, forecasts, annual reports etc., inspection reports, interim reports, position reports, reports issued by experts, scientific reports, technical reports, test reports, traffic reports, weather reports. Reports can be closely related to descriptions.

Representamen. See *Sign*.

Representation. A representation is a medium with a specific message. Sometimes a representation is called “information set,” or “material.” Together with the medium the message is the link between the sender or the designer and the intended receiver. I distinguish between two main categories of representations: 1) figurative representations, and 2) non-figurative representations. Figurative representations include two groups, visuals and graphic symbols. Visuals include three-dimensional images, photographs, realistic drawings, and schematic drawings. Graphic symbols include pictorial symbols, abstract symbols, and arbitrary symbols. Non-figurative representations or verbal symbols include verbal descriptions, nouns or labels, and letters and characters.

Representational style is a pictorial artistic style, an artist’s rendition of the subject that conforms to the subject in its true form.

Research. Message design and information design has a practical as well as a theoretical component. It is a difficult challenge to find a good balance between practical and theoretical work. The study of presentation of verbal and visual messages is a multi-dimensional, multi-disciplinary, and worldwide consideration. Information literacy, visual language, visual literacy, perception and learning are important concepts. To describe this research we may use words like creativity, flexibility and practical testing in both experimental and real life settings. New findings are tested and the results are confirmed in different situa-

tions and environments. See *Applied research, Practice and theory*.

Research methods. The researcher selects the most suitable methods depending on the project characteristics such as research question, knowledge areas and purpose. This aspect calls on flexibility in mind and handling. See *Applied research*.

Research on texts, their language, style, meaning, and social meaning has a long history. In contrast to the extensive research on text processing, and text design, there has been far less research on visuals printed in textbooks and used in other media.

Research process. A process for research in information design always starts with an analysis of the problem or the situation. This is followed by project planning, study of literature, collection of data, analysis of data, interpretation and discussion, and publishing of the final report. The research activity is creative in several aspects. The greatest influence of a creative approach seems to occur mostly in the beginning of the project. The amount of influence seems to decrease as the project evolves. This may be due to the fact that more guidelines are taken into consideration as the project becomes more concrete. Analysis and performance are woven together but does not occur at the same time.

Research reports. Information design is a young discipline, and a new area of knowledge. Existing scientific journals often hesitate to publish results generated by design researchers, scattered around the globe. It is hard to distribute new findings

and it will take a long time to build a common body of knowledge.

Response principles. People respond differently to the same message. Individuals differ in their ability to respond to a message. Individuals differ in their readiness to respond to a message. Individuals differ in their motivation to respond to a message. Reinforcement is helpful in establishing response. In learning, active participation is better than passive participation. Meaningful responses are easier to learn than meaningless responses.

Restrictions. To be able to produce a verbal message in any medium, it is important to understand the possibilities and the restrictions of verbal language. We need to know how oral and written verbal languages are constructed and perceived by various audiences and individuals. Major characteristics of verbal language are listed below in the form of short summary statements.

Reusability is the ability to use the same resource multiple times in multiple ways and in multiple contexts.

Reusable design is a design solution that may be used multiple times in multiple ways and in multiple contexts.

Reuse of existing *information elements* have been used in many areas, like architecture, art, design, furniture design, engineering, music, publishing, sculpture and many other fields. A classic example of extensive reuse is the *Nuremberg Chronicle (Liber Chronicarum)*, which was published in 1493. This illustrated world history is one of the first to successfully inte-

grate illustrations and text. The 600 pages include 1 809 illustrations. However, these illustrations are printed from only 645 woodcuts. At that time a single (and expensive) woodcut could be used to illustrate a number of different persons or a number of different cities.

Reversed line perspective. In a reversed line perspective, the foreground seems to be “smaller” than the background. The straight lines converge in the direction of the viewer. This perspective is frequent in Japanese and Chinese art, which seeks to draw the viewer into the picture to take an active part in the events depicted. In early Asian art there are no shadows. See *Line-based positional perspectives*.

Reviews. The intended audience should have the final say about the content, illustrations and sequences that are used in any information material. Administrators and others indirectly connected with a project usually will have an abundance of suggestions for revision, or state that they do not understand the message. But, the materials were not designed for this group. The documentation must be re-edited, and re-edited again until it receives the appropriate approval. It is a good principle in the production of information and learning materials to spend enough time and effort on editing text and pictures for better comprehensibility.

Rhetorical literacy is the ability to understanding the means of persuasion used in advertising and marketing communications in general. It is an awareness of who is being targeted in a certain advertisement.

Rhetorical skills. Professional communicators are visually and verbally fluent and draw on a large repertory of semiotic resources (words, images, sounds, numbers). They are not invested in one form or another, but always invested on what meets the needs of the stakeholders, their situation, and the available media. Professional communicators are comfortable with displacing one form (e.g., text) with another form (e.g., visual). When they work with design they can coordinate their representations of personal knowledge, the text they have produced so far, the needs of the stakeholders, and the context. They are able to fuse disparate items of content into a coherent whole. They need to decide what to say, how much to say, how to say it and why they make specific choices in particular rhetorical situations. Expert communicators strive to provide the “right” content at an appropriate level of detail in the most suitable media for the audience. See *Professional communicators*.

Rhodopsin. In the eye the retina’s receptors are excited by light and respond by chemically converting a pigment, rhodopsin (*visual purple*). This conversion triggers impulses that are transmitted along the optic nerve and the thalamus to the brain’s primary visual cortex. This takes only a few milliseconds. In the visual cortex the impulses are translated into a sensation of vision.

Riis. The Danish American journalist and photographer Jacob August Riis (1849–1914) used his talents to help the impoverished in New York City. In his book *How the Other Half Lives: Studies among the Tenements of New York* (1890) he documented the lives of poor people in New York.

Ring chart of disk is a schematic picture. See *Pie charts*.

Ripa. The Italian art historian and scholar Cesare Ripa (c. 1560–c. 1645) wrote *Iconologia*. It is a didactic encyclopaedia with a collection of alphabetically arranged symbolically conceived personified abstractions with verbal descriptions of the allegorical figures. Emblems in this book usually have a header, the name of the author, a picture, a caption, and a reference to the engraver, an explanatory text, and a section with references to sources. It was first published in Rome 1593, and followed by many editions. Ripa was knighted for the success of the book. The book was extremely influential in the 17th and 18th centuries. For more than three hundred years experts in art history all over Europe used *Iconologia* as their prime source of knowledge when they discussed description, identification, interpretation of the content of classical art. Cesare Ripa was the pseudonym of Giovanni Campani.

Risk management. See *Information assurance*.

Rodin. See *Auguste Rodin*.

Rock art is an archaeological term used to refer to human-made markings placed on natural stone. It is a form of *landscape art*. Prehistoric rock art include images that are carved, engraved, or painted on cave walls and ceilings, and on open-air boulder and cliff faces, rocks or exposed glaciated pavements, and slabs, and engraved into the ground. In some parts of the world images were painted or engraved on bone, eggshell, ivory, leather, portable pieces of rock, and on wood. Human and animal figures were also modelled and sculptured from bone, clay, ivory, and stone. Rock art is found in all parts of the globe ex-

cept Antarctica. Many terms are used for discussions about prehistoric rock art in the published literature, such as: petroglyphs, rock carvings, rock drawings, rock engravings, rock images, rock inscriptions, rock paintings, rock pictures, rock records, and rock sculptures. Archaeologists studying these artworks often believe that they likely had some kind of magical-religious significance. The available knowledge about rock art is increasing rapidly as this subject becomes a more acceptable and respected field of study within the social sciences. Rock carvings and pictographs are still being found in new areas around the world. See *Prehistory*.

Rock art motifs are pretty stereotypical. One group includes circular shapes, carved footprints, cup marks, hands, wheels, and wheel crosses. These images correspond to abstract nouns, which today are difficult to understand. Several images correspond to concrete nouns, such as “horse.” When a scene is showing how a man is driving a chariot with horses the pictures may correspond to a complete sentence. Among the mammals we can recognize bear, cattle, dog, horse, moose, pig, red deer, reindeer, seals, and whales. Most pictures show men, rarely women and never children. The most common motif is ships.

Rock carving audiences. It is clear that there were different audiences for the messages of the rock carvings. The first target group was the higher, spiritual powers. The second target group was people within their close circle, as the tribe, family, or group. The third target group was strangers. Archaeologists also suggest that at least some contemporary people could understand the messages. However, today we lack the relevant codes.

We cannot understand the images, and not understand how ancient people thought.

Rock carving craftsmen. An entirely new social system, supported by new gods and new religions developed during the Bronze Age. A new elite of skilled craftsmen and specialists developed. Many rock carvings are designed in a conscious way. It is obvious that the individual images are thoughtful and the results of very conscious efforts. Some interpretations suggest that there were special people with special skills who carried out the work to make the visual figurative carvings. A few people may have done complete carvings.

Rock carving graphic design. Many rock carvings are placed in relation to each other in panels on the rocks. There is probably often a deliberate graphic design that takes into account the natural conditions. Rock carvings are often placed on the sloping rock outcrops. We don't know if the rock carvings were stained from the beginning.

Rock carving messages. Previous interpretations of the purposes of the messages of the rock carvings were often related to trade contacts and hunting magic. Later interpretations may relate to people's view of the world, and the creation myth. Rock carvings have relatively few motifs. It is above all clear depictions of animals, objects and people. Several rock carvings contain intentionally designed message.

Rock carving oral tradition. Today both rock paintings and rock carvings lack words. However, oral traditions were strong and expressed ideological communication during the Bronze Age. Some ceremonies involved regulated religious rituals. Rock

carvings were part of various ceremonies. In addition to words sometimes even fire was used, and probably different form of dance, and perhaps music and other sounds.

Rock carvings, *petroglyphs*, are carved or engraved into the rock surface. Sites in Australia have rock carvings that are estimated to be as much as 27 000 years old, and in other places rock carvings could be as old as 40 000 years. In Scandinavia rock carvings were produced over a very long period of time, perhaps 5,000 years. For me it is clear that rock carvings are results of deliberate work with words, images and graphical form. I consider the several thousand-year-old panels with rock carvings as interesting *predecessors* of the kind of artefacts that are the result of work with information design today. The people who carved pictures in rocks probably worked on behalf of specific clients. They worked in a systematic way to plan and carry out the work with the help of the methods, tools and procedures that were available at the time of each assignment. Thus these individuals were ancient forerunners to those who work with information design today. See *Curvilinear decorations*, *Rectilinear decorations*, *Rock art*.

Rock drawings. See *Rock art*.

Rock engravings. See *Rock art*.

Rock images. See *Rock art*.

Rock inscriptions. See *Rock art*.

Rock paintings. There are *rock paintings*, or *pictographs*, in Africa, Mexico, North America, Siberia and Scandinavia. Rock paintings were made on vertical cliffs. There is often an over-

hang that has protected the paintings against rain and winds. Some rock paintings are found on major stone blocks. Places with rock paintings may be close to lakes or small and tranquil waterways, and also in places with good views over water. Rock paintings are often dated to the Neolithic period, perhaps to around 4,000 years ago. Rock paintings were often made with red, black and white mineral earths and other natural compounds. See *Rock art*.

Rock pictures. See *Rock art*.

Rock records. See *Rock art*.

Rock sculptures. See *Rock art*.

Role schemas organise our expectations in persons with particular roles and positions in society, and their behaviour in different situations. See *Long-term memory*.

Roman type style includes most of the typefaces used in modern printing. These typefaces have serifs, finishing strokes normally at the top and at the bottom of the main strokes of letters. Serif typefaces are often considered to make it easier to follow text lines and thus be easier to read than sans serif typefaces, except for small letter sizes. Common examples of serif typefaces are Baskerville, Berling, Bodoni, Bookman, Caslon, Century Old Style, Garamond, New Century Schoolbook, Palatino, and Times New Roman. See *Serifs*.

Roots. See *Information design genus*.

Rotogravure. See *Gravure*.

Rough, is a preliminary layout.

Roundness is the most common form in nature. When ink, water, or any other liquid material is dropped on a surface, it assumes a rounded form. See *Areas*.

Royalty. The steps involved in publishing are time-consuming and jointly represent a major expense. About ten percent of the price of a book, not including tax, usually goes to the author. Electronic publishing could change this situation to some extent. It reduces the distance between writers and readers. New opportunities for a dialogue may develop.

Rubin. The Danish psychologist/phenomenologist Edgar John Rubin (1886–1951) is especially famous for his optical illusion “the Rubin vase,” or the “the Rubin face,” that is seen either as a white vase, or as the profiles of two black heads. The interpretation fluctuates between the two possibilities even though the image on your retina remains constant. (However, this optical illusion is much older, examples can be found in 18th century French prints.) Rubin's theories became influential within Gestalt psychology, yet he really did not want to be included among the early Gestalt psychologists. See Figure-ground perception.

Rule. The only information design rule is: “Respect copyright, and other laws and regulations related to information.” See *Foundation*.

Rule of speaking. The most important rule of speaking is: “Respect your audience.”

Rule of thirds. According to the “rule of thirds” the centre of interest may be selected at any one of the four points where two

equidistant vertical and two horizontal lines divide a picture in a total of nine parts.

Rules are horizontal and vertical straight lines that are used in layout and typography. Horizontal lines can be used to separate sections in a text and rows in a table. Vertical lines can be used to separate columns of text on a page or columns in a table. It is, however, often better to use white space as a separating device. Rules that are wider than 12 points are called *bars* and *bands*. Sometimes horizontal bars have type in them. Rules may be in colour.

Runarounds. When text is “wrapped” around an irregularly shaped illustration this is known as a “runaround.” Runarounds almost never represent any improvements and should be avoided.

Rune stones are flat, raised stones, with preserved runic inscriptions. Most rune stones are located in Scandinavia. Runic inscriptions still convey messages to us from people living during the period 400–1100. Most of the rune stones were carved and erected during the last century of the Viking Age. Common purposes of rune stones were to mark territory, to explain inheritance, to boast about constructions, to tell of important events. Many of the rune stones were probably erected as memorial stones to bring glory to deceased men.

Runes. In Scandinavia our earliest known carved characters are called *runes*. The earliest runic inscription in Sweden is dated to around AD 200 (Zachrisson, 1999, p. 338). This inscription is on the tip of a spear, found in the province of Gotland. See *Runic inscriptions*.

Runic alphabets. There are several runic alphabets, or *Futhorks*.

Runic inscriptions. Runes and runic inscriptions were used in the Germanic languages before the adoption of the Latin alphabet, with its letters. People designed runes to be cut out in items made of wood. However, such items are rarely preserved and not present in archaeological finds. Runic inscriptions are preserved on flat, raised stones, but also on boulders, on bedrock, and on items like spears and buckles. See *Rune stones*.

Running heads. See *Headers*.

S

Sans serif type style has no serifs on the characters. These typefaces provide uniform weight when there are less-than-optimal reading conditions. They are often used for headings, labels in pictures, diagrams, captions and tables. Sans serif type can be used successfully for the body text in books, pamphlets and reports. Subjects perceive sans serif fonts as clean, modern and technical. Common examples are Avant Garde, Futura, Geneva, Gill, Helvetica, Optima, Univers, Venus, and Verdana. Sans serif type is seen as clean, modern and technical. Helvetica typefaces may be the most widely used among the sans serif typefaces in the world today. See *Serifs*.

Satire is often used in cartoons to point out a special situation, an occurrence, or an event. Usually satire should be totally avoided in materials for information and learning.

Saturation, sometimes called *chroma*, and *intensity*, is most closely related to the number of wavelengths contributing to a colour sensation. It is the apparent purity, or lack of greyness of a colour. Saturated colours are often considered to be aggressive, bold, daring, vibrant, and they may grab our attention. Un-saturated colours may be perceived as boring, dull, peaceful, restful, soft, weak, and they may sometimes be depressing. (Sometimes chroma is said to be the combination of hue and saturation.)

Scale describes the relative size or magnitude of a given design element in relation to other elements and to the design as a whole.

Scanners. There are several types of scanners, from equipment designed for amateurs to equipment for professional use. See *Desktop digitizers, Drum scanners, Flatbed scanners.*

Scarification. Scars in the skin form designs and pictures. There are several methods of scarification. Methods include branding, burning, cutting, etching, and scratching into the skin. See *Body art.*

Scatter graph is a schematic picture. See *Graphs.*

Scatter plot is a schematic picture. See *Graphs-*

Scatter plot graph is a schematic picture. See *Graphs.*

Scattergram is a schematic picture. See *Graphs.*

Schemata are made up of relationships or operations, or both, and of variables. Each schema provides slots into which new knowledge is placed. Schemata are constantly refreshed and restructured through new knowledge, while additional connections among related schemata are made. For competencies to be acquired, it is essential that the learner bring the important elements of knowledge required by the task. These elements of knowledge consist of concepts, propositions, episodes, production rules, procedures, or heuristics. New concepts are built on the foundation of older ones, and new propositions are formed with concepts already possessed by the learner. Processing of this kind is essential for experience, understanding, and expectations. See *Long-term memory.*

Schemata theory postulates that we have different partial impressions, such as, general knowledge about different types

of text, and different whole impressions of reality. The schemata that we bring to the fore when we read influence our deeper understanding of a text. The reading procedure is of great importance to the reader's capacity for understanding a text. In "normal reading," we direct our attention towards how we shall interpret the meaning of a sentence. Studying the syntax becomes subordinate to orienting our thoughts amid the semantic and pragmatic relationships that form the text's warp and woof. When we read long continuous texts, we process separate sentences with an eye to their integration into the material's entirety. This takes place gradually, with the text that we have already read providing the framework. The connection makes sense of the text.

Schematic pictures. In many situations we need to use *schematic pictures* such as blueprints, charts, engineering drawings, graphs, maps, etc. Schematic pictures are representations of reality, but they are often non-iconic and may lack any resemblance with reality. Avoid use of more than five colours, grey tones, or screen patterns in schematic pictures. Appropriate scales might be: (1) white–grey–black; and (2) white–light grey–grey–dark grey–black. When the final production is made with copying machines we should usually use only the first of these two scales. See *Schematic pictures–classification*, *Schematic pictures–creation*.

Schematic pictures–classification. There are several ways to classify schematic pictures. We can study how schematic pictures are executed, how and when they are used, and of what the content consists. This is an attempt to classify schematic pictures with respect to their type of illustration and their pur-

pose: 1) Word visuals. 2) Graphs. 3) Diagrams. 4) Matrices. 5) Plans. 6) Maps. 7) Metaphorical pictures. 8) Drawings. 9) Integrating text and pictures. 10) Integrating drawings and photographs

Schematic pictures—creation. Within large organisations it is a good idea to use standard image elements and standard symbols in schematic pictures. It is very cost-effective, and makes it far easier for all readers to understand the intended messages. The readability of schematic pictures is increased. A large variety of personal image elements and symbols makes it hard for readers to understand the messages. Technical documentation must be easy to comprehend. Thus it is important to be consistent and to use the same symbols in different schematic pictures.

Schwabacher is a black-letter type style used in the *Gutenberg Bible*.

Science of design is the scientific analysis of the design activities performed via scientific methods.

Scientific design has its foundation in industrial design, and deals with methods, intuitive and non-intuitive, in modern design practice.

Scientific language must be capable of effectively conveying as much information as possible to a certain group of readers. It is characterised in its ideal form by brevity, clarity, and precision. See *Comprehensibility*.

Scientific literacy is the knowledge and understanding of scientific concepts and processes required for personal decision

making, participation in civic and cultural affairs, and economic productivity. A scientifically literate person is able to describe, explain, and predict natural phenomena.

Scientific visualization is the selection and transformation of data from experiments or simulations into visual representations, often animations or graphics. It is then easier to analyze and understand the data. Important areas are astrophysical visualization, chemical visualization, and medical visualization. See *Visualization*.

Screen displays. General design rules should be employed in the design of screen displays. Thus material should be arranged and displayed so that it is easy to read, from top to bottom and from left to right. A visual display design may vary with respect to spatial organization like headings, length of lines, justification, spacing, number of columns, number of colours at the same “page,” and directive cues like colour coding, twinkling characters or words, and scrolling text. When text is shown on a visual display, there is no easily read colour combination. The best text colour is black, which causes good contrast to most background colours. The best combination is black text on a white or yellow background.

Screen literacy, *multimedia literacy*, *new media literacy*, is the ability to cope with the numerous media in use today.

Screen-printing. In screen-printing, or *silk-screen-printing*, the printing form is a fine-meshed screen, mounted over a frame. For many years it was a hand process used for making banners, personal greeting cards, posters, and signs. In the 1950s techniques for making screen stencils photo mechanically

were developed. Ink is spread over the screen and pushed through the open mesh areas with a rubber- or plastic-bladed squeegee to produce a print. Screen-printing is used for printing advertisements, placards, and posters on foil, glass, metal, paper, plastic, textile fabrics, and wood. Silk-screen-printing is also used for many other industrial applications, e.g., for printing of electronic circuit cards.

Screen typography. Compared with traditional graphic presentations, a presentation of information on visual displays such as television sets and computer terminals is very limited. Still, information may be presented in many different ways. See *Colour displays, Interface design, Visual displays*.

Scribbling. When small children are scribbling they make dots, lines, and endless open circular movements. Already three-year old kids may draw solid circles, triangles and squares. In my view we perceive circles, triangles and squares on a low cognitive level without any special analysis.

Script fonts are seen as elegant, formal, organic, and personal.

Script type style looks somewhat like modern handwriting that is carefully executed with a brush dipped in India ink. The individual characters are joined together. It is not possible to use script type for whole words in upper case, or capital letters. Examples are Constance, Palace Script, and Zaph Chancery

SECAM. France, Eastern Europe, the former Soviet Union, and Saudi Arabia use *SECAM*, Sequential Couleur à Mémoire. SECAM is so similar to PAL that it is possible to receive a SECAM-program in a PAL television-receiver, but the colour signals are

produced in a different way. In a digital television or video camera there is a CCD-plate with normally more than 400,000 pixels.

Secondary subjects are variables that will influence our perception of individuals in photographs. Other people in a photograph, the context of the individual, may influence how people view a photograph.

Securing quality. In information design the content of the message is more important than its context, execution, and format. Data and facts must be correct and also relevant to the situation. The information designer must make reviews during the production process and correct as many mistakes as possible. See *Archive pictures, Good information material, Good picture, High credibility, Poor picture, Quality.*

Security is one of the key factors to handle in the information age. If a Chief Information Officer doesn't create a relevant security structure for the organisation, he will fail in his responsibilities. The information age demands organizations to have high information assurance.

See behind objects. Current laser techniques make it possible to create three-dimensional images, holograms, enabling viewers to see "behind" image objects. These techniques are at about the same stage of development as photography was at the beginning of the century. Many people are aware of the dramatic developments in photographic and film techniques since that time. The development of holography is dramatic, although more rapid in coming decades.

Segmented bar is a schematic picture. See *Bar charts*.

Segmented graph is a schematic picture. See *Graphs*.

Segmented pie chart is a schematic picture. See *Pie charts*.

Segmented volume is a schematic picture. See *Diagrams*.

Selection. The presentation of all the information available in a field is seldom possible. Normally, information-providers and other writers make a selection. This selection can be more or less subjective. The selection is seldom, or perhaps never, objective. This is difficult or even impossible. You need to have access to all the information to be presented before you can decide on the mix of words and pictures. This decision depends on the most appropriate form of representation in every individual instance. The different media have completely different abilities to convey information. For example, reading texts on a television screen is difficult.

Selection of information. Conveying redundant information through both linguistic and iconic symbols facilitates information processing, reduces error and information loss, and increases the amount of information that learners can recall. Linguistic and iconic symbols make it possible for the learners to alternate between functionally independent, though interconnected and complementary cognitive processing systems. In the production of information or learning materials this is not always the case.

Selection of pictures. Every published picture has been selected, not only once but usually several times. First the picture creator, the photographer, and/or the artist makes a selection of

the subject matter. The photographer makes the initial decision as to how much or how little of a situation will be on the film. In any given situation a lot of different pictures may be produced. Then the editor, art director, and/or the designer make a selection among various pictures in a collection or in a picture archive. In instructional materials a picture should never be used just because it is pretty. Every picture should have some information to convey—if it doesn't, it should be left out.

Selection of typefaces. The decision of which typeface to select should rest largely on the purpose and on the intended audience for the document. Using the correct typeface for the job is based on solving a problem and meeting a need. *Private documents* may invite the use of ornate and stylish looking fonts. *Professional documents*, however, require maximum legibility. *Advertisements* must be noticed. Therefore, it is important to choose a graphical form that arouses interest. When it comes to *information materials*, the graphical form should basically be simple and “transparent” and not arouse any special interest or attention for its own part.

Selective perception. The reader isolates instances of a specific category from other visual elements.

Self-schemas organise our considerations of ourselves as persons. The image of the self is important to us. People's mental schemas are continuously developing, and every day we meet reality with a somewhat different view than the day before. See *Long-term memory*.

Semantic emphasis. The human face is of universal interest and attracts attention.

Semantic information theory refers to the information supplied by a proposition in terms of the proposition's probability, and specifies the principles for measuring information.

Semantic location. Known size of an object can indicate depth.

Semantic memories consist of conceptual information such as our knowledge of the names of birds and flowers. The information that passes the "register" can proceed in different ways. See *Memory*.

Semantic text parallels refer to distinguishing features of an object that serve to identify that object correctly. Here images and words are matched.

Semantic unity is the possibility to identify an image. See *Unity*.

Semantics is the study of the meaning of verbal expressions and the implications of combinations of words.

Semi-linear structure. In a hypertext system the text is organized into a web of nodes connected with links. Each node contains some text. There can be one or more links from one node to other nodes. Thus, the text can be structured into different layers with detailed information, explanations, definitions etc. Hypermedia systems also incorporate still images, animations, video, and sound into the nodes. Navigation in hypermedia systems is less regulated than navigation in hypertext systems. Still, navigation is restricted to the pre-defined structure of nodes and links. However, experience can be relatively free and associative if the systems are well designed. To some

extent it is possible to browse through hypermedia systems and look for images. However, any computer based search is based on alphanumeric characters and not on iconic signs.

Semicolon (;) join two grammatically complete, independent clauses to form a single, compound sentence.

Semiology. See *Sign*.

Semiotic object. See *Sign*.

Semiotic studies. See *Semiotics*.

Semiotics, *semiotic studies*, refers to the the study of meaning of signs. All meanings are heavily culturally dependent. In short, we distinguish between the first expressions, which is what we perceive immediately (*significant*) and the content, i.e. the meaning (*signifié*). The distinction between expression and content is similar to the one between “denotation“ and “connotation“. Denotation is the external reference of a *sign*, whereas “connotation” is our experience of a sign, where various associations are included. Semiotics is related to linguistics. The study of the relation between signs and their effects on the people is called *pragmatics*. The relations among signs in formal structures are studied in *syntactics*. The study of the relation between signs and the things to which they refer is called *semantics*. See *Sign*.

Sender. Generally speaking, a sender may be an advertiser, an artist, a businessperson, an instructor, a subject matter expert, a teacher, a writer, a film or television producer, or anyone who wants to convey an intended message to one or more receivers or information providers.

Sender activities. In the production and distribution of a verbal and visual message, the sender will use creative processes, production processes, and distribution processes.

Sennefer was “Mayor of Thebes” in Egypt during the reign of Amenhotep II. He was buried in the small, richly decorated tomb. Several lines with pictographic verbal expressions are combined with interesting pictures to tell the stories in scenes on the walls and on the four pillars. Scenes show the funeral procession, the offerings, and the worshipping of the gods. The realistic grapevine design of the entire undulating ceiling has given way to a colourful geometric pattern representing decorative textiles. This is very *early information design*.

Senses. With our sense organs we observe and record the world outside our own bodies. We are capable of successfully feeling, hearing, seeing, smelling, and tasting things at the same time. We are also capable of simultaneously hearing different stimuli in either ear. However, we are probably incapable of simultaneously perceiving different stimuli aimed at the right and the left eye, respectively. The same kind of stimulus may easily be perceived in different ways at different times. See *Attention*.

Sensory memory, or the *immediate memory*, is the first step in memory functions based on information processing in several steps. It carries out the storage of stimulus information at the peripheral level and transfers it to the short-term memory. Hearing a sentence, a word, or even a syllable requires the listener to integrate a changing pattern of auditory stimulation. This integration demands some form of short, temporary buffer

storage, and it is likely that perception relies heavily on such temporary memory stores that holds a representation of the initial sounds until the entire word has been heard. Another example of the sensory memory is the biochemical processes in the eye. The visual cells there possess some inertia and, therefore, function as a kind of memory. The sensory memory normally stores information for half a second to one second. See *Memory*.

Sensory-motor-skill. See *Perceptual motor-skill*.

Separation. Use of separation devices such as bullets, numbers, and letters facilitate recall of information in list form.

Sequence. People who have not learned to read or write do not necessarily look at pictures in the order that has been intended by the designer. Therefore it often proves helpful, as messages are being tested, to ask several groups of people to arrange the individual message into a sequence that seems most logical to them.

Sequential Couleur à Mémoire. See *SECAM*.

Serif-evolution system is a classification scheme of type styles. There are eight main classes: 1) Venetian, 2) Old Style (Dutch-English and French), 3) Transitional, 4) Modern, 5) Contemporary (sans serif and square serifs), 6) Black letter, 7) Scripts, and 8) Decorative letters.

Serifs are the terminal strokes, normally at the top and bottom of the main strokes of letters in a *Roman type style*. Serifs are not just put there for decoration. They help us distinguish between characters, and make it easier to follow the horizontal

lines with text. There are four main types of serifs: bracketed serif, hairline serif, wedge serif, and slab serif.

Serigraph is a colour print that is made by *serigraphy*.

Serigraphy is an adaptation of the silk-screen process. Here the stencils are hand-cut by artists for the production of screen prints as a fine art, *serigraphs*. See *Silk-screen*.

Service sector. A number of measures aimed at making the service sector more efficient have been implemented to some extent. For purely economic reasons, the same efficiency measures will also be introduced in the information sector. The number of people employed here will not continue to rise as quickly in the future. Nor will we be able to increase our information consumption very much in the future. The information must be more effective.

Shaded letters, *shadow letters*, have strong three-dimensional quality by use of heavy shadows on one side of main stroke. See *Emphasis in text*.

Shadow perspective. In a *shadow perspective* projected shadows, or drop shadows, are sharply accentuated as a means of displaying the location of different objects and their spatial relations to each other. Even some of the old rock paintings in caves reveal attempts at producing an impression of depth, by the suggestion of simple cast shadows. However, cast shadows may create confusion and they may actually impair legibility and communication.

Shadows. A shadow is an area without light from any light source. Without shadows it may be hard to make out the basic

contour of an object. Shadows define space. The *attached shadow* is on the actual object. It helps to reveal the basic form and dimensions of that object. The *cast shadow* is frequently observed as being independent of the object that caused it. Depending on the angle of the light source, the cast shadow may reveal the basic shape and location of the object that caused it. The surface appears to be curved when the light falls off gradually. A highly directional (hard) light produces fast fall-off. Thus, a curved surface is emphasised. See *Acoustic shadow*.

Shannon and Weaver. The Shannon and Weaver communications theory was originally developed in the 1940s for studies of telecommunications and other technical systems. However, the theory has also been used as a model for communications between people. A sender (e.g., a telex unit) communicates with one or more receivers (other telex units) via a channel. The sender codes the transmitted signal, and the receiver decodes the received signal. Information theory utilizes the bit as the smallest unit of information. A bit can either be a one or a zero, representing, e.g., yes/no or on/off. See *Information theory*.

Shape. Irregular and unpredictable shapes dominate over basic and regular shapes. These unpredictable shapes attract more attention than basic and regular shapes. Most people can easily perceive the basic shapes, and there is a large degree of perceptual constancy in the perception of shape. The picture area in drawing, painting, and still photography can have any shape and orientation. Most pictures, though, are cropped and published in square or rectangular formats.

Due to their simplicity circles, triangles and squares are often used as symbols and as picture elements in schematic pic-

tures. However, this simplicity also means that different persons can perceive these shapes in many ways. Functional, instructive graphic symbols are probably older than words, and they are probably found in every culture.

The circle, the equilateral triangle, and the square express visual directions. Circles suggest curved directions, triangles suggest diagonal directions, and squares suggest horizontal and vertical directions. Shapes can be made in a number of ways. They may be defined as the outlines of objects, or parts from different objects. Shapes may also exist as gaps, or “negative space” between objects.

Shape constancy is our tendency to judge shapes as the same despite changes in distance, viewing angle, and illumination. This is one of the reasons that circles, ovals, rectangles, squares and triangles often are used in symbols and icons. See *Perceptual constancy*.

Short-term memory, STM, is also called *operative memory*, or *working memory*. After being processed in the iconic memory and the echoic memory, some information is passed on to the STM where it is only retained briefly. A number of complex operations are carried out here during problem solving. But the STM has severe capacity limitations. New information replaces information that is older than about a second, and the older information easily disappears. Information that has entered the short-term memory can proceed through a filter that selects the information to be passed on to the long-term memory. Once this filtration has taken place and certain information units have been assigned priority over others, these priority units are given access to a “register” with a limited memory capacity. This

is when a person becomes aware of the stored information. All other non-priority information disappears, normally forever if it is not retransmitted to the filter when the filter is able to accept the traffic. The filter scrutinizes the information received from the outside world and identifies the specific properties of this information.

When the information involves aural signals, the filter notes whether the signal is strong or weak. When visual signals are involved, the signal is scrutinized for information on for example colour, size, direction, and movement. Long, complex words and sentences are difficult to understand. If the functions of the individual words in a text are not immediately apparent to us, our short-term memory becomes overloaded with long chains of words that cannot be directly put into a meaningful context. If we repeat the information a few times, we increase our chances of remembering. To facilitate cognitive processing of new information learners generally use rehearsal strategies.

Showscan uses 70-mm film and is projected with 60 pictures per second on a curved, very large screen. The fast projection and the six-channel sound, makes it possible to produce very realistic fast courses of events, like car hunts, etc. As in IMAX and OMAX the audience sits high up in a slanting auditorium, with a shorter distance to the screen. The system is overwhelming also because of the large screen, which goes all the way from the floor to the ceiling.

SIG, Special Interest Group. See *ID SIG*.

Sign. In semiotics a *sign* is “something that stands for something.” It is a discrete unit of meaning and includes all of the

ways in which a message can be communicated. According to Charles Sanders Peirce (1839–1914) a *sign* is composed of three semiotic elements in a three-part relationship: *representamen*, *semiotic object* and *interpretand*. The *representamen* represents the denoted object. The *semiotic object*, *object*, or *referent* is that which the sign represents. The *interpretand*, or *interpretant sign*, is the meaning of the sign interpreted (or decoded) by the viewer. Peirce used the term Semiotics. According to Ferdinand de Saussure (1857–1913) a *sign* is composed of two parts, the *signifier* and the *signified*. The *signifier* is the word (etc.) that represents the denoted object. The *signified* is the concept, the meaning, the thing that is indicated by the signifier. It is a *referent* to which the signifier refers. Saussure used the term Semiology.

Sign language. There are many examples of sign languages. We can see examples of “formal” signs almost every day. Deaf people are often very skilled in using their highly developed and structured visual verbal sign language. Other less sophisticated kinds of sign languages are used by, e.g., umpires in sporting events, traffic policemen, people directing airplanes on the ground, etc. Further examples are the sign languages used in the production of radio and television programs, and movies.

Sign learning. Learning new vocabularies, new terms and conventions, as well as mathematical, chemical, and geographic symbols all involve some degree of conditioning. To some extent it is a simple instance of stimulus learning. In knowing the sign for something, a person makes a response to the sign, similar to what he or she would make to the real object. This is called sign learning.

Sign similarity. According to the *sign similarity orientation theory* learning will be more complete as the number of cues in the learning situation increases.

Signified. See *Sign*.

Signifier. See *Sign*.

Signs are visual graphics that display information, typically on how to find various places inside and outside of buildings. See *Wayfinding, Wayshowing*.

Signs and symbols. A special area of emphasis is the design of signs and symbols. Warning signs must have a high contrast relative to their background. Informative words shall be used for signals such as “Danger”; for descriptions of a hazard such as “Shallow water”; and for specific actions that should or should not be performed, such as “No diving.”

Signs and words. Our ability to communicate was greatly enhanced when we began to store data and information with the aid of simple pictures and, subsequently, symbolic characters a few thousand years ago. Pictograms became increasingly stylized and evolved into simple symbols or characters. Each character was equivalent to one or more concepts and came to represent a word. Written languages, composed of individual letters, provide the bases for storage of information and for communications between people at a great distance from one another in terms of both time and space. See *Alphabetic languages, Pictographic languages*.

Silk-screen-printing. See *Screen-printing*.

Similarity principle is also known as the law of similarity, and the theory of similarity. We tend to perceive and group our impressions on the basis of their similarity, all other things being equal. Events, objects, and units that look alike, resemble each other, and share similar characteristics and properties belong together. It can be qualities like brightness, colour, darkness, orientation, pattern, shape, size, texture, value, or other qualities. We group them into perceptual units. Elements that are different are not part of the group. One black sheep in a flock of white sheep tends to be noticed. The similarity principle is one of the most powerful organizing principles and one of the most useful in information design for facilitating perceptual organisation of data.

Simple indexing. Pictures may be indexed according to category, motif, and subject. Geographic area, and name of persons may be other classification concepts. Commercial photo agencies often permit direct, manual, and visual perusal of originals or copies in each category. Institutional photo archives, as used in education and research, are often unable to manage without some kind of cataloguing. Many indexing systems are based on hierarchic classification of picture subjects according to a pre-determined code or on systematic catalogues in which every index word has a corresponding alphabetical or alpha-numerical designation.

Simple instructions is a term for a group of information materials in the category *Brief messages*. An instruction is explanatory information on an appropriate procedure in a given situation. Distinct and short instructions are involved. The instructions may be impressed or printed on different products,

such as doors and signs, in the form of letters, symbols or words. Distinguishing between ‘push’ and ‘pull’ may be appropriate when we open a door. In traffic many road signs provide instructions on how people should drive. Instructions can also be conveyed with signals. This may be the case e.g. in a football match or when ground staff instructs a pilot in a taxiing aircraft about the right gate.

Simplicity. Providing simplicity in text, illustrations, and graphic form is probably one of the most important principles in information design. It should be a priority for the information designer to make use of the guidelines related to these areas. The subject matter in technical and scientific texts is often complex and may be difficult to grasp. But what makes a text difficult to read is not as often the subject matter or the combination of spelling, grammar, and syntax as the style.

Simultaneous perspective was a spatial dimension in art of the Middle Ages. By fragmenting the image architectural structures looked both flat and three-dimensional. Some of Braque's paintings (1908–1913) reflected his interest in geometry and simultaneous perspective. See *Psychological perspectives*.

Single scale is a kind of graph. See *Graphs*.

Single-loop learning exists when errors are found and can be corrected without changing policies or goals. Single-loop learning deals with acceptance without questions. Single-loop learning is equal with activities that give an increased knowledge base, competence, and routines without changing the fundamental nature of activities.

Situated learning. Normally learning is a function of the activity, context and culture in which it occurs. Learning is situated. Social interaction is a critical component of situated learning—learners become involved in a “community of practice.” This contrasts with most classroom learning activities which involve knowledge which is abstract and out of context.

Size. It is easier for us to distinguish between lines than between areas or volumes. When we judge the size of objects, e.g., areas, we are apparently most influenced by the length of horizontal lines or horizontal distances. In most contexts the differences in the sizes of circles, squares, triangles, ellipses and other two-dimensional symbols are underestimated.

Size and depth. The perception of size is related to perceived distance, and the perception of distance is reciprocally related to perceived size. Regardless of distance there is constancy in the perception of the size of known objects. This is called size constancy.

Size constancy is our tendency to judge sizes as the same despite changes in distance, viewing angle, and illumination. See *Perceptual constancy*.

Size of illustrations can be calculated according to the percentage of the page occupied by the illustrations. Illustrated pages are mentally divided into quarters and each illustration coded as occupying up to 25% of the page, 26–50% of the page, 51–75% of the page, or more than 75% of the page.

Size of subjects. The most important part of the subject must be large and clear, take up a large proportion of the image area,

and be perceivable as an entirety. Large visual elements in a picture attract the attention of the reader. The perception of size is influenced by colour, context, and grey scale. Open and light forms are perceived as being larger than closed and darker forms of the same shape. We may easily perceive oval areas of the same size as different if they have different colours. A line can be considered long when it is compared with a shorter line, but at the same time it can be considered short when it is compared with a longer line. There can be no large without small, and no small without large. It is usually a good idea to include some familiar object, like a person, a tree, or a car to supply the scale for judging the size of an unfamiliar object.

Size of type. There are different systems in Europe and USA for measuring size in typography. In the *Pica system* 12 points = 4.2333 mm. In the *Didot system* 12 points = 4.511 mm. In the *Mediaan system* 12 points = 4.205 mm. The most common programs for desktop publishing use the Pica system, giving points as “pts.” Running text in a book should be set between nine and twelve Pica points. A line of 40–50 characters or “strokes” results in a line length of 75–90 millimetres in a book or a paper. A text column may be widened up to 120 millimetres to accommodate more text, and still be easy to read for an experienced reader.

Skimming. An active reader is skilled in skimming the text. Skimming enables the reader to pick out key words and main ideas in the text and, thereby, obtain a great deal of information. Some texts contain so little new information that skimming is all that is required. Before reading a chapter in a textbook, it is helpful to skim the material to identify key topics and

to gain a general idea of the structure of the chapter. Difficult material, however, cannot be fully comprehended by skimming or by speed reading.

Slide. According to the standard for 5 x 5 slides the film is 24 x 36 mm. The picture surface is 22,5 x 34,5 mm, which is a height-to-width ratio of 1:1.533. This is quite close to the golden mean (1:1.618). The actual frame is 5 x 5 cm. It is not enough that a slide be well designed and has a high technical quality. It should also be projected and used in a correct way. A room must be properly darkened for the most advantageous projection of mounted slides and filmstrips, unless equipment is available for back projection, i.e., projection from the rear onto a matte-glass screen. A slide's subject should appear against a black background. See *Legibility of projected texts, Slide projector*.

Slide projector is a projector used to project slides. The complete image should be projected on the screen, in a dark room. If parts of the image fall on the wall, outside the screen, this may be quite disturbing. Slide projectors used to be very common, but framed slides and slide projectors are being superseded by systems for projection of images stored in computers. See *Slides*.

Small caps or *small capitals* is an alternative set of capitals used for text setting. These SMALL CAPITALS are smaller than standard CAPITALS.

Snow. The English physician John Snow (1813–1858) illustrated the clusters of cholera cases in the London epidemic of 1854 with a *dot map*. With his statistics Snow could demon-

strate the connection between the bad quality of polluted water from the Thames and the high number of cholera cases. Snow's study is regarded as the founding event of the science of epidemiology.

Social context is an external context. It is the entire communication situation, i.e., the senders and the intentions of the message, the receivers and their circumstances. See *Context perspective*.

Social information, the result of all information measures whose aim is to make it easier for citizens to know what their rights, privileges, and obligations are, is studied in social science subjects. Good social information should be readily accessible, tailored to local requirements, readily grasped, adapted to individual needs, and capable of creating a state of preparedness in the receiver. Social information must be closely integrated with the activities of the respective authorities, professionally planned and designed, and disseminated through efficient media.

Social intelligence. See *Interpersonal intelligence*.

Social learning. The social-learning theory is concerned with human social interaction. It has its origin in behaviouristic studies of animal learning. Already the Soviet psychologist Lev Vygotsky (1896–1934) stressed that much of what we learn we learn from others in a social setting. The social-learning theory focuses on the behaviour patterns that people develop in response to their specific environments.

Social literacy includes the ability to acquire and develop knowledge and understanding of responsible social behaviour and positive human values. A socially literate person is able to act positively and responsibly in complex social settings.

Social skills. Professional communicators are able to *read the context* and scope out social resources. They are noticing opportunities that can enable them to exert change. They possess rich rhetorical memories about the people they have designed for—readers, audiences, stakeholders, communities, or users. They expect that their work will be circulated and used in various lengths, formats, and media. The same content may be distributed as printed publications, Web-pages, and video. Professional communicators embrace the dynamics of content reuse in organizational settings. They are adaptive to complexity in the workplace. They are strategic in building alliances with others who may help them to achieve long-term goals for design processes and products. See *Professional communicators*.

Solid user interface. The term solid user interface (SUI) was coined in Japan to describe products with embedded microprocessors, such as video cassette recorders, photocopiers and cellular phones, and to distinguish them from the graphic user interfaces (GUI's) of computer applications. Although products with SUI's play a significant part in our everyday lives and earn substantial revenue from sales in both industrial and consumer applications, SUI's have been a neglected area in design research.

Sound is a subjective sensation of hearing, i.e., the sensory cells in the inner ear's hearing apparatus are stimulated. In ob-

jective terms, sound consists of longitudinal wave motions capable of acting on our hearing apparatus and thereby eliciting sound sensations. Man is normally capable of perceiving sound waves at frequencies from 16 to 20,000 Hz. Sound waves lower than 16 Hz are referred to as infrasound, and frequencies higher than 20,000 Hz are referred to as ultrasound. See *Sound design*.

Sound design is the process of acquiring, designing, generating, manipulating, recording, and specifying sound elements in audio productions. Sound design has been used since prehistoric times to evoke emotions, reflect moods, and underscore different actions in dances and plays. Today sound design is also used in art installations, design of internal environments, filmmaking, live performances, radio productions, television productions, theatres, and video games etcetera. The Baroque sculptor Bernini was an early conscious sound designer. He created several “naturalistic fountains” with carefully designed sound effects of rippling water. See *Sound designer*.

Sound designer. The Baroque sculptor Bernini created several “naturalistic fountains” with carefully designed sound effects of rippling water. One of the most beautiful is *Fontana del Tritone* (Fountain of the Triton) in Piazza Barberini (1642–1643). From his shell the sea god Triton has sprayed water through a conch for more than 350 years. Bernini was a very conscious sound designer. See *Bernini*.

Sound intensity, i.e., the average rate of sound energy transmitted per unit of time and unit area that passes a plane perpendicular to the transmission direction, is an objective meas-

ure of sound intensity. It is usually measured in w/m^2 (watts per square meter). However, a psychologically based concept is necessary in order to designate the strength of sound waves striking our ears. The hearing range is the interval between the lowest sound intensity we are capable of perceiving, i.e., the auditory threshold, and the highest level we are able to tolerate, i.e., the pain threshold.

Sound media are CD-DA, gramophone records, cassette tapes, sound archives, tape recordings, audio cassettes and sound cards. Sound media can be put into four groups based on the ways they can be used and the technology involved: 1) Records. 2) Audio tape. 3) Sound card. 4) “Firm” memory.

Soundscape. There are foreground sounds, context sounds, and background sounds.

Source credibility. Studies on “source credibility” seems to agree on the existence of both an expertise or a competence factor, and also a trustworthiness or a safety factor. There are obviously various levels of credibility. At least we can distinguish between high and low levels. A source with a high degree of trustworthiness may be described with words like agreeable, calm, congenial, ethical, fair, forgiving, friendly, gentle, honest, hospitable, just, kind, nice, patient, pleasant, sociable, unselfish, and warm. The opposite words would describe a source with a low degree of trustworthiness. A source with a high degree of expertise may be described with words like able, accurate, authoritative, experienced, informed, intelligent, knowledgeable, skilful, and trained. In this case the opposite words would describe a source with a low degree of expertise.

Space is an important tool in typography. Space separates letters, clauses, phrases, paragraphs, subsections and chapters from one another. Consistent spacing in a document will help the readers to: 1) Increase the rate of reading because they are more able to see redundancies. 2) Access the more personally relevant pieces of information. 3) See the structure of the document. See *Space between letters, Space between words, Spacing*.

Space between letters. The amount of space between letters varies in each line depending on the actual words and the actual line length. Space between letters in text should not be too loose, or too tight. Rounded and acute shapes need to be extended in order to appear to be of equal height relative to a square. The distance between characters is sometimes too long. This is especially true for headlines in capitals. Visual alignment depends on careful optical adjustment to compensate for differences in shape of the element being aligned. See *Kerning, Space, Space between words, Spacing*.

Space between words. Space between words varies in each line depending on the actual words and the actual line length. First the computer system adds word spacing and then, if the space between words becomes too excessive, the system will add letter spacing. The distance between words shall be smaller than the distance between lines, and larger than the distance between characters. Space between elements should be used as a legibility tool. The distance between words should be relatively small. When the text has optimal spacing we can keep the reading rhythm constant. See *Space, Space between letters, Spacing*.

Spacing. Visual design should be based on perceptual, rather than on physical phenomena. Compensation for shortcomings of our human vision is often required. Visual alignment depends on careful optical adjustment to compensate for differences in shape of the element being aligned. Text with a generous amount of space within it is rated as “easier” and “more interesting” than text that has a more solid appearance. For comfortable reading it must be easy to distinguish between words. See *Kerning, Space, Space between letters, Space between words*.

Spatial concentration principle. We perceptually group regions of similar element density. Thus a visual element may belong to one group even if it is as close to another group.

Spatial intelligence, visual intelligence, is the ability to paint, take great photographs, and create sculptures. People with visual intelligence create mental images, use metaphors, and have a sense of gestalt. They like to engage in drawing, painting, and sculpting. These people can easily read maps, charts, and diagrams. This is the kind of ability used by architects, sculptors, painters, navigators, chess players, naturalists, and pilots.

Spatial perspectives include *Line-based positional perspectives, Area-based positional perspectives, and Other positional perspectives*.

Spatial proximity. See Proximity principle.

Speaking and writing are language-related activities performed by the sender. These activities are influenced by the sender's earlier observations, and by the terminology and the

language he or she uses. Besides being active, the sender is in charge of encoding the message, that is, its production and distribution.

Special designs. Astronomical, chemical, mathematical, and medical signs are examples of groups of special designs, important for use in these areas.

Species. See *Design science*.

Speech. An anterior zone in the left frontal cortex, Broca's area, is thought to articulate speech. A posterior zone, Wernicke's area, is thought to be the repository for the ideas to be articulated. The two areas are connected so that expression of ideas through speech can take place.

Speech and body language. The speaker must constantly strive to maintain close contact with individual listeners in order to insure that they understand the information. Listeners cannot back up and review oral information in the same way that they can with printed information. Every presentation should commence with an overview of the content to be discussed, and conclude with a summary. This will enable listeners to obtain the best possible grasp of the total message. Including time for questions is also appropriate. See *Body language, Body messages, Speech and stills*.

Speech and moving pictures. Interactive video programs make it possible to combine sound and moving pictures. They can arouse considerable activity and commitment in the user and function well as a conveyor of information and as a teaching aid. When people flip through 15 to 20 television channels in

less than a minute to decide which programme they want to see, they do not take the time to actually listen to the sound. Decisions are based on the pictorial style of content.

Speech and stills. Whenever visuals are displayed, the speaker always runs the risk of losing contact with the audience. Suggestive visuals can easily create a number of associations that deflect the audience's thoughts away from the subject of the presentation. However, the speaker can pave the way for improved audience comprehension of a subsequent visual by disclosing in advance what the visual depicts. The audience will then find it easier to identify important picture content and select a relevant interpretation. When a picture is shown, viewers need some time to interpret and understand its contents.

Spelling. For non-native English speakers it is often hard to distinguish between British and American English. There is a variety of usage between the suffixes -ise and -ize in verbs (and in nouns that end with -isation or -ization). The source of the suffix is Greek (-izo), a suffix that has been added to Greek, Latin, French, and English words. The American convention is to use -ize; in Britain both spellings prevail.

Spirals showing circular continuity are schematic pictures. See *Metaphorical pictures*.

Spoken languages. The term "spoken language" is almost always taken to mean direct, informal verbal language. A sender and a receiver share a highly interactive communications situation. This situation offers immediate feedback and opportunities for explanations and corrections. As is the case for the written language, the language of broadcast media is edited so a

wide range of listeners/viewers, with widely varying backgrounds, will be able to understand the content. See *Verbal languages*.

Spoken messages. It is important that the listeners understand the words in oral presentations. In the spoken message distinctness is comparable to readability in the written message. A widespread use of visuals in oral presentations is evident, as is the need to improve the quality of such presentations in a variety of dimensions.

Spreads are two facing pages in books, etc.

Stacked area graph is a schematic picture. See *Graphs*.

Stacked bar is a schematic picture. See *Bar charts*.

Stacked curve is a schematic picture. See *Graphs*.

Staircase leading to a target is a schematic picture. See *Metaphorical pictures*.

Standard paper. In Europe, the standard paper size is *A4* (210 x 297 millimetre), whereas in the USA, *Letter* (216 x 279.5 millimetre) is the standard. It is possible to deal with these differences by varying the margins on the page. It should be possible to print a document and insert the pages directly into a loose-leaf binder. This means that right-hand and left-hand pages should have the same appearance, basically a right-hand page layout. See *External access*.

Standards. In organisations with worldwide activities technical documentation may be produced at one place and distributed over Internet to many other places. In such cases the

typefaces that are used must be available as standard selections in computers and in laser printers in all these countries. Even so, printouts made by different printers will not be identical in appearance. Typography and layout should produce good results on standard paper. It should be possible to print a document and insert the pages directly into a loose-leaf binder. This means that right-hand and left-hand pages should have the same appearance, basically a right-hand page layout. See *Digital documents*, *External access*, *Standard paper*.

Statistical literacy is a term used to describe the ability to understand statistics and relationships of numerical information. It is necessary for citizens to be able to critically evaluate and understand numeric information presented in different media such as Internet, newspapers and television. See *Numeracy*.

Steel-die engraving. See *Copperplate engraving*.

Stencil is a device made of a thin and tough cardboard, metal, or resistant paper where open areas, that represent a design, image, or text, are cut away. See *Stencil printing*.

Stencil printing is a method of transferring a pattern by forcing dye, ink or paint through the open areas of a stencil onto a surface. It has been used for decoration of ceilings and walls, furniture, leather, pottery, and textiles. See *Stencil*.

Steiner. See *Alciato*.

Still pictures. Visuals are perceived much more rapidly and readily than text. Visual messages are a powerful form of com-

munication. See *Image functions–communication*, *Image functions–information design*, *Image functions–learning*.

Stimuli. Among the thousands of stimuli in the external context we only see, hear, smell, feel, taste, or “pay attention to” one stimulus at a time. Attention is sudden, direct, and distinct. The sequential flow of attention to the parts of a message is determined by the sequence in which information is presented to us. There are always far more stimuli than we can ever notice at any given situation. To us most stimuli remain unknown, unseen and unheard of. Attention, or mental preparedness and receptiveness, can be considered as the activation of groups of brain cells. Smell, taste and feeling are very important senses in natural life, but they are not as yet important factors when we want to use traditional media. We can pay attention to the content of a message, to the execution of that message, to the context in which the message is presented, and to the actual format or medium that carries the message.

STM. See *Short-term memory*.

Stock images. See *Stock photography*.

Stock photography, *stock images*, is a collection of photographs that can be licensed for use in various creative assignments. Usually the cost is lower than hiring a photographer. Images are often searchable in online databases. See *Photo archives*.

Stone circles. Over 900 ancient stone circles found throughout Britain and Ireland were positioned with reference to the movements of the sun. Mankind has used circles, triangles and

squares as important symbols for thousands of years. See *Newgrange*.

Stonehenge is a huge prehistoric circular monument of large standing stones in Wiltshire, close to Salisbury in the southern part of England (Coe et al., 1986). There are many theories but nobody knows why Stonehenge was built, or how it was continuously used for almost 1,600 years. Several archaeologists believe that Stonehenge was constructed in three phases anywhere from 3,100 BC to 2,000 BC. Some believe that Stonehenge is a very advanced *solar calendar* that was used mainly to make advanced and intricate astronomical observations in order to predict eclipse, equinox, solstice, and other celestial events important to a contemporary religion (Hawkins & White, 1970). Others reject this theory and believe that Stonehenge mainly was a site of *religious significance* and a place for *ancestor worship*. There are also several other theories regarding the actual function of this monument.

Straight line graph is a schematic picture. See *Graphs*.

Strategic learning. See *Double-loop learning*.

Structural complexity. The simplest form of a “one-dimensional” representation is a simple acoustic signal, such as a baby’s cry. A higher degree of complexity is found in texts and music. Music is always structurally more complex than text but can, of course, sometimes be “simple” in content. The greater the degree of structural complexity, the closer the representation approaches reality at a given time, in a given place, and in a given context.

Structure. A well-structured printed information material is divided into chapters and sections that work well together as a whole. A well laid-out table of contents gives the reader a quick and thorough idea of the whole document. A well worked-through index and clear page numbering make it easier for the reader to find the information. In a document stored in a computer it is possible to use automatic search functions. In some documents it is possible to use hypertext links for quick jumps between different parts of the material, and even between different documents.

Structure of content. Normally the structure of an instructional message is built to be continuous, to form a connected whole that presents the message clearly to learners. A well-defined structure of content facilitates understanding and learning.

Structure-dimension is based on the actual organization of the information. There are several hybrids of linear and non-linear organization of information. Videotex, videodiscs, hypertext, papers, hypermedia, interactive multimedia systems, and expert systems can be used for illustrating the “Structure-dimension.”

Study perspectives. We can study each individual information document from various perspectives in order to obtain multifarious information and, therefore, be in a position to develop greater knowledge in the field. Some examples of perspectives are target groups, themes, media, production techniques, modes of presentation, occupational roles and objectives.

Style is the way of expressing thoughts. See *Style guides*, *Style of graphic form*, *Style of illustration*, *Style of text*.

Style guides. Style of text is dependent on the specific choice of words, consistency, and expressions. There are a vast number of style guides and publication manuals available. Usually such documents outline standards for design and writing for a specific publication or organization. Like language itself, many style guides change with time. Therefore they are updated on a regular basis. However, it should be noted that there are some style guides that focus on clarity and legibility with guidelines on typography and layout rather than on readability. Furthermore web site style guides focus on a publication's visual and technical aspects, best usage, grammar, prose style, punctuation, and spelling.

Style of graphic form is dependent on the specific choices of typefaces for headings, running text, captions, and also the use of justification, number and placement of columns, number and placement of pictures and tables, the use of colour cues, etcetera.

Style of illustration is dependent on the specific choice of drawings, photographs, schematic pictures, and other kinds of pictures, as well as consistency, expressions, picture elements, and symbols. A drawing style that includes many different kinds of lines, patterns, shadings, and inconsistent use of symbols may obstruct the reading and understanding of the picture content. A schematic picture has good readability when it is easy for the reader to understand the message.

Style of text is dependent on the specific choice of words, consistency, and expressions. Abstract words, jargon, long and complex sentences, passive constructions, and stilted language may obstruct reading and understanding of the text content. The choice of words, expressions, symbols, and picture elements creates the style. A writing style that includes abstract words, long and complex sentences, stilted language, jargon, and passive constructions may obstruct the reading of the text. A drawing style that includes many different kinds of patterns, shadings, and lines, and inconsistent use of symbols may obstruct the reading of the pictures.

Stylistic variation of type. With respect to line thickness, inclination, and width characters in a typeface can be drawn in many different versions. The major examples of stylistic variation of regular text are **bold**, *italic*, and ***bold italic***. The visual weight and visual impression varies a lot. It may be compared with physical weight. A small and extra bold and expanded character may be seen as heavier than a large, light and condensed character.

Stylized drawing is a schematic picture. See *Drawings*.

Sub-project leaders are responsible for their respective information materials, and are ultimately responsible for making sure that their documents are ready on time. The subproject leaders have continuous contact with all parties involved in the whole process. One very important aspect is copyright clearance for all materials; audio, text and visuals, brought into the design process.

Subject index. A well-constructed subject index is often an indispensable tool for quickly finding information in books. As is the case with bibliographies, the readers are usually looking only for certain information when they refer to a list of this kind.

Subject matter experts produce the very first, “raw” draft with the necessary subject matter facts and information: both text and pictures. Because it is important to secure the quality the subject matter experts may also take part in the reviews of the information or learning material. See *Instructional technologist*.

Subject matter manager may be responsible for outlining the subject matter contents in the whole project, and dividing the parts between the different information materials. In large projects, there may be several subject matter managers involved.

Subject matter reviewers review the subject matter contents in both text and pictures. It is very important that information and information materials are technically correct and relevant to the situation. Today, patents and other intellectual property matters are an increasingly important source of income for many commercial organisations.

Subliminal messages. In 1957 an advertising expert claimed that he had inserted subliminal visual messages in a showing of *Picnic*, a popular film. The messages, which said “Eat Popcorn” and “Drink Coke,” supposedly caused people to rush to the refreshment stand and purchase these items. This story received much attention and a lot of publicity, and it is often cited in the

literature. However, several years later, the advertising expert admitted that he had invented the whole story in order to get favourable publicity for his advertising business. No subliminal visual messages were used and no customers rushed out to buy popcorn and Coke.

Subliminal reception may be defined as the individual's ability to perceive and respond to stimuli that are below the "limen" or level of consciousness. Above it stimuli are called supraliminal. It seems apparent that the phenomenon of subliminal reception is a scientifically demonstrated phenomenon.

Subscript, characters that are set lower than the body of text, like the figure 2 in x_2 . See *Superscript*.

Subtractive colour. Looking at a picture printed in colour we experience a *subtractive colour combination*. The inks, dyes, and pigments function like filters for the white light and present colour to the eye by reflection. The wavelengths of light are absorbed (subtracted) in different ways. When printing on white paper, yellow and magenta (a red-purple colour) produce red. Yellow and cyan (a blue-green colour) create green. Magenta and cyan give blue. A mix of all three primary colours will become black. The black ink gives the picture a distinct sharpness and more solid dark elements. Using the primary colours painters can mix paints of other hues. See *Additive colour*.

Successful learning. Information literacy is central to all successful learning and by extension to all successful living. All of us face an information-rich future in which change will be one of the few constants of our life experience. The ability to adapt

and fulfil our individual potentials will require us to be life-long learners and independent decision-makers.

Successful messages must fulfil several requirements. The messages must: reach the decoders, be powerful, have sufficient time, be perceptible, be possible to decode, have proper hierarchy, have decoder prepared, have integrity, be properly crafted, be credible, have congruity and be exiting.

Suger of Nola (1081–1151). The Abbot argued that the Latin texts in scrolls on the walls in the churches served as clarification of the messages in the pictures in the churches (Sandquist Öberg, 2009, p. 26).

Suggestive pictures. The borderline between realistic and suggestive pictures is indistinct. Some visuals may be considered as suggestive pictures in one context but as realistic pictures in another context. Ambiguous pictures, which often express moods and emotions, are often referred to as suggestive pictures.

Suggestive properties are more important than functional properties in “artistic pictures.” Art is not primarily a question of objects. It is more a visual language for dissemination of ideas and experiences that are difficult to put across in words. Irrespective of the sender’s intentions, different receivers may respond in an emotional manner to a picture with mainly functional properties. In the corresponding manner, some viewers may respond unemotional and functional to pictures with predominantly suggestive properties. See *Properties of visual language*.

Sullivan. The British graphic designer *Peter Sullivan* (1932–1996) was a pioneer in the design and use of information graphics in *The Sunday Times*.

Summaries. Important messages like summaries can be boxed-in to gain special attention. If the lines are shorter, the effect is even more obvious. Boxes usually have thin lines. Boxes may sometimes be filled with a background colour.

Superficial knowledge. We can easily learn a little about a great many subjects. However, this kind of learning leaves us with little more than a broad base of superficial knowledge. We need to learn to locate, access, evaluate, process, understand, and use information.

Superscript, characters that are set higher than the body of text, like the figure 2 in x^2 . See *Subscript*.

Supplementation dimension. See *Pictorial dimensions*.

Supraliminal is above the level of consciousness. See *Subliminal messages*, *Subliminal reception*.

Surface chart is a schematic picture. See *Diagrams*.

Syllabary correlates a symbol to a syllable. Here groups of phonemes form words. Syllabaries may have 80–100 symbols. There are also other categories of writing systems.

Symbols. Various symbols can be used to aid communication. A good symbol is designed so it can be used in many different situations and in many contexts. A good symbol is simple, clear, has optimal size, good contrast in form, dimension, and colour. There are cultural as well as individual differences in interpret-

ing the meanings of symbols. Few people share the same understanding of any given symbol. People can usually not guess the meaning of symbols. Symbols should be used in a consistent way. A symbol must always have the same meaning within a specified context. See *Graphic symbols, Symbol colours, Symbols and message*.

Symbol colours. Unfortunately, red and green are quite often used as discriminating colours in symbols and in warning signs. Since many colour-blind people perceive red and green as grey, colour can only be used to code the information redundantly. Colour may be combined with shape, and position, or with both, which is often seen in traffic signs. Complementary colours contrast, and they provide a warm–cool effect.

Symbolism. There is often a major difference between the denotation, the literal meaning, and the various connotations, associative meanings, and private associations. Many visuals have a symbolic content and meaning. To every person the flag of her or his nation is a symbol that means “my country.” A lion is the symbol for courage, a lamb suggests gentleness, and the dove with an olive branch symbolizes peace. Sometimes symbolic pictures are simplified to symbols.

Symbols and message. In accordance with international conventions and national legislations on road signs and signals, most road signs have a similar design. Warning signs are triangular. Information or instructional signs are rectangular or rhombic. Prohibitory signs and mandatory signs are round, but with different colours. A specific message may be communicated to the receiver/s or interpreter/s with several different

symbols. People have to learn the meaning of all the important symbols within their own society. Symbols need explanations. A specific symbol may be used to communicate several different messages.

Symbols as language. See *Graphic symbols*.

Symmetrical layout. By tradition page layout is based on symmetrical page design. Centred as well as justified texts are examples of symmetrical layout. Symmetry is axial balance. It is logical and simple to design. Symmetrical page design is static and may be perceived as boring. Symmetrical as well as asymmetrical layouts can have a good balance. See *Symmetry, Symmetry principle*.

Symmetry. The Greeks introduced the concept of symmetry in the fifth century. This was based on their observations about the natural world. Roman artists developed symmetric arrangements of letters and graphic elements. For centuries monks produced hand-drawn manuscripts in their monasteries. They paid careful attention to the selection and placement of each graphic element, and they tried to maintain a consistent style throughout every single work. See *Symmetrical layout*.

Symmetry principle is also known as the law of symmetry. We tend to group symmetrical components together. Our minds perceptually connect unconnected elements to form coherent shapes. Regions that are enclosed by symmetrical borders tend to be perceived as coherent figures. See *Symmetrical layout, Symmetry*.

Syncrony principle states that visual events that occur at the same time will tend to be perceived as going on together.

Synopsis. When the purpose, the objectives, the receivers, and the type of representation for the intended message are decided, it is possible to start working on a synopsis. A subject matter expert or a work group produces the synopsis, an overview of the forthcoming information or learning material. It is important, already at this stage, to decide on a suitable structure of the material. This creates the conditions for the material to have a good reading value for the intended readers. The contents and the structure of the synopsis may be reviewed and approved by an expert or by a special committee with sufficient subject matter expertise.

Syntactic emphasis refers to the use of cues for attracting and directing the attention of the viewer.

Syntactic location refers to depiction of depth with the use of converging lines, etc.

Syntactic text parallels refer to the physical/spatial relationship between pictorial and verbal signs.

Syntactic unity is an acknowledgement that an image exists. A minimum requirement is that the bounds of each image should be discernible. See *Unity*.

Syntactics. See *Semiotics*.

Syntagms, sub-meanings i.e., words, phrases, sentences, and complete texts, are formed by combined morphemes. See *Morphemes*, *Phonemes*.

Syntax is the study of the rules for combining words into grammatical phrases, clauses, sentences and paragraphs. There are differences between the syntax in different languages. Non-native speakers will easily create texts that are not trustworthy. Write in your mother tongue instead, and let a professional translator adapt the text to the other language.

Systematic catalogues. See *Inconclass, Outline*.

Systems design. See *Design science*.

Systems development. See *Design science*.

Systems visualization integrates existing visualization methodologies to find new ways to visualize complex systems. The goal is to provide the ability for the audience to understand systems complexity. See *Visualization*.

T

Table of contents. There are many ways to make a table of contents. Justified or unjustified text may be used. The important thing is that the structure of the content is visible. The references to page numbers must be clear. If a table of contents is extensive, it may be rendered in two columns. References to page numbers are often shown for heading levels 1 to 2, or 1 to 3, with indents for each successive level. Heading levels 4 and 5 are usually not shown in the table of contents. This would impair the possibility to get an overview and understanding of the overall structure.

Tables. Readers prefer vertically oriented tables where it is easy to see the target entries, and then quickly find the data in the table cells to the right. Horizontally oriented tables are harder to use and more difficult to understand. The type used in tables should not be smaller than 8-point, and not larger than 12-point.

Tabloid. The most commonly used paper sizes in North America are called *Ledger*, *Legal*, *Letter*, and *Tabloid*. A Tabloid size paper is 279 x 432 mm (11 × 17 in).

Tactile modality. See *Kinaesthetic modality*.

Target groups. See *Receiver groups*.

Target images. A target image is the mental image a person forms about her/his future in life. Dreams, visions, hopes, or fears are decisive to a person's involvement in preparations for her/his future.

Target populations. See *Receiver groups*.

Tattoo. A tattoo is form of body modification, a drawing on the skin that is formed of carvings or engravings with sharp objects, often inlaid with durable colours that are darker than the skin. Tattooing has been practiced for centuries all parts of the world, especially in Japan, Polynesia and Southeast Asia. Various cultures have had their own tattoo traditions. See *Body art*.

Teaching aids is a term for a category of information materials. Teaching aids are pedagogic adjuncts for direct use in training, instruction and education. The objective is for the receiver to learn an intended subject, i.e. acquire new knowledge and new experience. In time, the receiver may become familiar with the subject matter, gain insight and learning and, ultimately, knowledge in one or more subjects.

Technacy is the ability to understand, apply and communicate creative and balanced technological solutions that are based on understanding the contextual factors involved.

Technical communication is any form of factual communication about technical processes, products, and services. Any media can be used technical communication. It can be data sheets, documents, forms, online help, journal articles, patents, user manuals, specifications, and videos. The goal is to create easily accessible information. See *Technical communicators*.

Technical communicators work with technical communication intended for specific audiences. See *Technical communication*, *Technical writers*.

Technical documentation. In organisations with worldwide activities technical documentation may be produced at one place and distributed over the Internet to many other places. In such cases the typefaces that are used must be available as standard selections in computers and in laser printers in all these countries. Nevertheless, printouts made by different printers will not be identical in appearance. Typography and layout should produce good results on standard paper. See *External access*.

Technical editors. See *Technical writers*.

Technical expert. See *Instructional technologist*.

Technical factors, programming factors, language factors, and contextual factors all influence the viewer's ability of perception, learning, and memory with respect to the function of the brain and the sensory organs. To achieve "good quality" man-machine interaction, we have to consider all these factors in a kind of "wholeness-perspective." To learn we must be able to hear, see and also understand the message. In my view, it is no use to develop new, advanced systems and forget the aspects of the human factors. Such systems will never be successful in the long run. In a printed material, such as a book, the table of contents and the index make it easier to find information according to one's wishes. When a person has read a page in a book, he or she may easily proceed to additional information by turning the page.

Technical illustrations are diagrams and drawings of man-made materials, constructions and objects, sometimes including the situations in which they are used and the processes and sys-

tems in which they are incorporated. The main purpose of a technical illustration is to describe or explain these objects and constructions to a more or less non-technical audience. Images need to be clear and provide an overall impression of what an object is or what it does.

Technical language must be capable of effectively conveying as much information as possible to a certain group of readers. It is characterised in its ideal form by brevity, clarity, and precision.

Technical quality. Obviously, the technical quality of a visual should be “good” and tailored to the specific medium. A printed picture should be matte and distinct, not blurred, overly glossy, or dazzling. Resolution should be sufficient for the reproduction of the desired details. Fine details in the texture of a visual disappear in the dot screen structure of the printed image. Even more detail is lost in a television image, or on a computer visual display. Poor technical quality is far too common in information materials. The result of most of the previous work on visualization and making originals can easily be destroyed by a single error in the making of the master or in the actual production of the copies.

Technical visualization is often performed with computer-aided design, CAD, and may sometimes render 3-D models. It is an important aspect of product development. See *Product visualization, Visualization*.

Technical writers, technical editors, technical communicators and *information designers* work on the texts and materials delivered by the subject matter experts and by the information

brokers and they produce a finished text. This work encompasses the whole spectrum from simple editing of well-written text, to completely rewriting of text to convey the intentions of the subject matter experts to the readers. If there are many contributors to a particular section, it is important to bring a uniformity of linguistic usage and writing style across the complete information or learning material. Linguistic consultants may do this. In certain cases, it may be necessary to get the help from skilled translators.

Technically crafted visuals can be made in a relatively brief period of time and easily reach a wide public. A TV camera can take live pictures viewed simultaneously by millions of people in different countries. In this way, we can “attend” various happenings, such as sporting events, no matter where they occur. The ease with which news pictures can be produced and distributed may influence the selection of pictures. Sensational events, such as a disaster, may be assigned a relatively large amount of space in the mass media because pictures such as these attract widespread interest. Here, the mass media bear an enormous responsibility in their editing and selection of pictures. See *Picture circle*, *Realistic pictures*, *Schematic pictures*, *Suggestive pictures*, *Symbols*.

Technological competency is the ability to create, repair, or operate specific technologies.

Technological literacy has a variety of meanings worldwide from skilled use of computers, to the ability to assess, know, manage, understand and use the technical language for a technological genre. It complements *technological competency*.

Technology includes the systematic study of technique as well as the application of science to the solution of practical problems.

Technology for pictures. In the earliest printed books images were printed from woodcuts. During the 1600s and 1700s copperplates dominated. This meant that the technical quality of printed images increased significantly, but there was a great distance to the text. In the 1800s, lithography dominated. It became possible to print pictures in colour, but the technology meant that it was no longer possible to print continuous texts and images in the same printing presses. Thus words and pictures were irretrievably separated from each other for a long time. Development of the offset and other printing methods during the 1900s laid the foundation for a real change. The previous technical barriers are now eliminated with the help of computer-aided production of graphical products. See *Technology for words*.

Technology for words. Before Gutenberg's time, it was a "natural relationship" between words, images and graphical form. All expressions were gathered in the same hand-written page, or printed from the same block of wood. However, the production of images was equally demanding and time-consuming as before with complicated handwork. In the earliest printed books images were printed from woodcuts. See *Gutenberg Bible, Printing technology, Technology for pictures*.

Technology of instruction may be seen as an outgrowth from instructional technology. It is the study of acquisition of complex human behaviours in formal instructional settings will

contribute to the theory of knowledge acquisition within the science of cognition, and to the technology of instruction.

TEL, *Technology-enhanced learning*, is a kind of E-learning. See *E-learning*.

Tele media include answering service, datel, datex, facsimile, Internet, Intranet, teleconferencing, telegraphy, telepak, telephone calls, teletex, telex, videoconferencing, videotex, view-phones and voicemail.

Telefax. The telefax is used to send text and image information via the telephone network. The area of the paper is often divided into approximately two million pixels: 50 dots per inch horizontally and 90-385 dots per inch vertically. The very best resolution divides an A4-paper into 6 million pixels. It is common that telefax machines work thermally with heat sensitive paper in rolls of approximately 100 meters. There are, however, also fax machines built on laser printers. Many telefax machines can be connected to personal computers and then can be used both as scanners and printers.

Telephoto, *photo fax*, is a special kind of telefax equipment used for sending and receiving pictures in a full grey scale. There is also a system for colour pictures that transmits the pictures colour-separated. The transmission is done over the radio or the telephone network. Telephoto pictures are mostly used by newspapers and by some television stations. A thermal printer can be used to print the pictures.

Television. The word “television” comes from the Greek word *téle*, distant, and from the Latin word *vidére*, to see. Television,

or TV, is a tele technical system for transmission of sound and images, stills, as well as motion pictures in both black and white and colour.

In an analogue television camera, the rays of light are projected as an optical picture on a “picture plate.” By optic-electrical conversion the light variations are transformed into a low-frequency image signal, a so-called video signal. A focused electron beam moving across the picture according to a set pattern scans the image on the picture plate, different brands working in different ways. Usually the picture is divided into picture elements by the electron beam moving in slightly inclined lines building up a so called television-raster. At transmission, the light information is transmitted from one picture element at a time. These are projected reversed on the television-receiver’s picture tubes. The television-image is of course built up, or “put together”, in the same way as it was divided into picture elements earlier. The inertia of the eye makes us perceive the different picture elements as individual whole images or as motion pictures.

In a digital television camera, the rays of light are divided into a large number of pixels.

See *Television aspect ratio*, *Television literacy*, *Television printing*, *Television receivers*, *Television systems*.

Television aspect ratio. The aspect ratio of the classical television systems NTSC, PAL, SECAM is 4:3. This was a logical choice, since that was the aspect ratio of movie film at the time when television developed.

Television literacy, *critical television viewing skills*, includes factors that enable persons to distinguish among a wide range

of programme elements so they can make judicious use of their viewing time. The term television literacy has been widely used in recent years, both by researchers and by educators. Television has its own conventions, its own grammar; the success of a television production depends on how carefully it is crafted. Programs are judged by the size of the audience they generate and by the market they offer the advertiser. Television narratives convey a number of implicit and explicit ideological messages; these messages suggest what and who is important, and are generally representative of the values held by the dominant groups in society. Television viewers sometimes have great difficulties in comprehending broadcasted news.

Television printing. There are several systems for printing television and video images on paper. Some video printers use thermal copying, others use plotters, and some employ ink-jet printers or laser printers

Television receivers. There are television-receivers in a number of types and sizes. The image size is measured diagonally in inches. The most common sizes are 18–27 inches for domestic use and 28–38 inches for public use. See *Jumbotron*, *Multivision*, *Pocket-TV*, *Third generation-television*, *Wrist-TV*.

Television systems. See *NTSC*, *PAL*, *SECAM*.

Templates. See *Cost effective typography*.

Temporal lobes on each side of the cerebral cortex in the brain process hearing.

Term. A term, or a technical expression, is a word or expression for a particular concept found in a given field of work, in

which it has a specific and carefully determined meaning. A term can be regarded as a “label” and need not be exhaustively explanatory.

Terminal mark. Sometimes terminal marks appear after the last paragraph in texts in magazines and other periodical publications. A terminal mark is often a circle or a square, filled or unfilled. Sometimes the terminal mark is the initials or the signature of the writer.

Terminology. Research and development is generating a never-ceasing flow of new concepts and new terms. In pioneering technologies, clear-cut definitions and descriptions of concepts, processes, products, and services are particularly important. Simultaneous development in different parts of the world involves the risk of similar terms being used with different meanings, or—vice versa—dissimilar concepts being given identical terms. As a result, coordination in some form or other is needed.

Terminology administration. The terminology administration is responsible for the organisation of the terminology work within the organisation. The administration successively produces a list of terms, or a combined glossary, from those locally compiled by the terminology coordinators. See *Terminology*.

Terminology committees. The terminology coordinators may organise one or more—temporary or permanent—“terminology committees.” These committees discuss concepts and terms of importance to several staff members in different departments or groups. A terminology committee may occasionally include a representative of the terminology administra-

tion, and will have good contact with the “terminology council.” See *Terminology*.

Terminology coordinators continuously collect new terms and concepts related to their own field of activities and expertise, and compile their department or project glossaries. See *Terminology*.

Terminology council. Most of the work on single concepts is done in preparation for, and to follow up, the meetings of the terminology council. In accordance with a publishing schedule the terminology council may choose to produce a glossary and an encyclopaedia. The council discusses all kinds of problems of common interest in the work with new terminology and then make the necessary decisions, e.g. when different departments use the same term for different concepts. See *Terminology, Terminology work*.

Terminology experts may review the information and learning materials with respect to the use of consistent terminology.

Terminology requirements. When we develop a terminology with concepts and terms within a specific area it is important to set up some requirements, such as: 1) Terms should be linguistically effective. Avoid synonyms and technical terms that are misleading. 2) Terms should be precise. Write clearly, avoid too narrow definitions, too wide definitions, as well as circular definitions. 3) Definitions and descriptions should be correct, easy to understand, short, and have good legibility and readability. 4) Terms should be compatible with the language system in which they are used. Use positive terms instead of negating their opposites. 5) Terms should be derivable and generative. 6)

Terms should be “transparent.” 7) A term may be an pronounceable acronym, written with capital letters. 8) People within the specific area should accept terms, even internationally. See *Conceptual models*.

Terminology study. The study of terminology encompasses study of concepts, conceptual systems, definitions, idioms, references, semantics, and terms.

Terminology work involves continuous collection, review, description, definition, and presentation of new concepts and their terms. These terms should be made available as soon as possible to the people who need to have access to them in their daily work. This may be done as printed or electronic documents. Individual staff members or groups of staff create new concepts and new terms. This means that there will be a number of “originators” of “preliminary terms” or “working terms”, and their corresponding descriptions and definitions. The tangible results of the terminology work may be a glossary and an encyclopaedia. The glossary usually contains brief explanations of terms. The encyclopaedia describes terms in more detail and may also include symbols, illustrations, and conceptual models. The glossary and the encyclopaedia may be stored in a common database, or printed as books or booklets, in order to be accessed by all staff over an internal computer network or over Internet. See *Originators of terms*, *Terminology administration*, *Terminology committees*, *Terminology council*, *Terminology coordinators*, *Terminology experts*.

Text colour. Certain parts of a text may be printed with colours or printed on top of backgrounds in other colours. The

most legible combinations of print colours are black or dark brown text on a light yellow background. Other combinations may attract more attention but are less legible and, thus, require larger type. A text can be easy to read in any colour, provided the colour of the background is carefully selected. However, generally speaking, the best text colour is black, which causes good contrast to most background colours. In a similar way the best background colour is black, because it has good contrast to most text colours. People dislike the use of more than three or four text colours on the same page, screen, or slide.

Text comprehension is a constructive process, in which the readers build their perception of the whole by integrating the text with their own experiences.

Text design. To succeed as writers we need to know as much as possible about our readers, the purpose of our writing, and how the message is to be conveyed to the readers. Good text design is direct and simple. Our messages need to have good credibility.

Text face is the part of a page with text.

Text in pictures should be distinct and short. Avoid using several lines. Use Helvetica or other sans serif typefaces.

Text layout is typographic variation to present the content in a text in a clear way. Text must have a typography that facilitates its legibility. Headings, sub-headings, main text, captions, boxes, summaries, etc., must be clearly distinguished from one another.

Text on overhead transparencies. See *See Legibility of projected texts, Overhead transparencies.*

Text on PowerPoint. See *Legibility of projected texts, PowerPoint presentations.*

Text on screens. See *Legibility of text on screens.*

Text on slides. See *Legibility of projected texts.*

Text on visual displays. See *Legibility of text on screens.*

Text on wall charts. See *Legibility of text on wall charts.*

Text standards. To avoid distracting the readers, the linguistic usage as well as the style should be correct. There are several good books available for British as well as American English. See *Abbreviations, Acronyms, Adverbs, Agreements, Colon, Commas, Full stops, Hyphens, Prepositions, Pronouns, Punctuation, Semicolon, Spelling, Syntax.*

Text structures. The *writer's text* is different from the reader's text. The writer deals with a document that becomes progressively more formal. The *reader's text* is different. It betrays little of the complexity and the difficulties of the writing process. Usually printed texts vary a great deal from their original manuscripts with respect to letter-forms, line length, line endings, page breaks, page size, spelling, spacing, punctuation, etc., and even in the use of words. Often the printed text has illustrations. There may be drawings as well as photographs in the final product. As desktop publishing systems have become more common, this situation has changed a great deal. In personal publishing the writer is responsible not only for the con-

tent of the text and pictures but also for the editing and the graphic design. The writer's text and the reader's text will be the same. The writer may very well know his or her own subject matter but will have to also learn at least some of the traditional skills of the editor and of the graphic designer.

Text, picture, and background. A typical page in a telephone directory is almost filled with text. There are no pictures, and the margins are narrow. Here, the text may cover 90 percent of the page. In dictionaries the text covers 75–80 percent, and in specialist books and factual study books the text often covers 50–60 percent of the page. In pure literature and children's books, the text area is often even smaller than that. When a picture covers the entire page, there is no space for text or margins. We can use a "verbal and visual area diagram" to easily compare the relationship between text area, picture area. See *Verbal and visual area diagram*.

Textbook visuals. During the 19th century, textbook visuals were often placed vertically to provide better use of page space. Often, one picture was used to depict different persons or towns. Visuals were often a kind of "painting" with little or no real interaction with the text. In most books, pictures served primarily as an artistic supplement to the text. However, visuals have been used in a more intentional way in non-fiction books. As early as in the Middle Ages, some secular texts were illustrated. Medical science, for example demanded knowledge of herbs and plant recognition and was improved by clear and analytical drawings as early as in the 5th century. Colour, when used, was true to life. Each illustration had a text under it, stating the characteristics of the herb and its medical use. However,

copies made from earlier manuscripts, rather than from living plants, ultimately transformed the illustrations into stylised forms—very different from the botanical reality.

Textualis is a black-letter type style used in the *Gutenberg Bible*.

Texture is the visual equivalent of the sense of touch and the feel of an object's surface. From our experience we know that a sweater is “soft,” a steel tube is “hard,” and that a piece of broken glass has a “sharp” edge when we touch it gently with our fingertips. We can see minute variations in colour and structure of a surface. In our daily lives we have great use of our perception and understanding of texture when we look at various objects in our surroundings. Optical texture serves as a stand-in for the qualities of actually touching and sensing the real objects. Texture makes objects appear to be smooth or rough, soft or hard, heavy or light, sharp or flat according to our personal experience of these objects. We can avoid touching a hot stove. We can be very careful when we have to pick up sharp pieces of broken glass and sharp-pointed and sharp-edged pieces of metal. Optical texture also works in visuals.

Theoretical component. See *Combined disciplines*.

Theoretical practice. See *Combined disciplines*.

Theory may be defined as a number of assumptions or statements that conceptualises diverse phenomena, and systematises our knowledge about them. A theory illustrates how and why something is.

Theory and practice. Information design is complementary to information technology in the same way as architecture, or “architectural design” is complementary to building technology. Architecture has a practical as well as a theoretical component. This is also true for information design as well as for several other disciplines, such as: dance, economics, education, engineering, fine arts, journalism, medicine, music and theatre. Like the two faces of a coin, infography and infology are the two main components or parts of message design, and also the two main parts of information design.

Any graphic message should be legible, readable, and well worth reading for the intended audience. Any audio message should be audible, distinct, and well worth listening to for the intended audience. Therefore every information designer needs to have theoretical knowledge as well as practical skills.

Adding a theoretical view to the practice of design is to reflect on the aims, methods, and the results of this practice. In order to perform sound reflections, and do a qualified reflection, we need concepts both to structure our thoughts, and to describe them verbally.

Theory of closure. See *Closure principle*.

Theory of direction. See *Continuity principle*.

Theory of figure and ground. See *Figure and ground principle*.

Theory of similarity. See *Similarity principle*.

Thermal printers print dot matrix characters. A font is equipped with small needles. These point to an especially pre-

pared, heat-sensitive paper. The needles are heated in a pattern that corresponds to the character to be printed, and the heat-sensitive paper is affected. Thermal printers often have a resolution of 200 dots per inch. To create colour pictures, foils with yellow, magenta, and cyan colour are used. By combining these foils a great number of colours can be produced. In desktop systems the number of colours is 256. In this system the colour is heated over to the image paper point by point. There are also thermal printers that heat up small ampoules inside a special paper so that the colour spreads inside the paper.

Third generation-television. VLSI (Very Large Scale Integration) chips control the image quality in every individual television-set. The television-station's analogue signal is transformed to digital signals, and they can then be processed in different ways. The image is cleared of shadows and noise, and its definition is improved. The picture can be zoomed in and "frozen". It is possible to produce prints of any still, simply by pressing the "print" button. A video printer produces the picture. Third generation television-systems might have a large, flat screen mounted on the wall with a possibility to open up several "windows" with different programs. It is not necessary to have an extra home computer for access to, for example, electronic shopping, home banking, and information retrieval in databases.

Three-dimensional representations, like dioramas, models, sculptures and stereo pictures, may always be interpreted in more than one way. Laser techniques make it possible to create three-dimensional images, holograms, enabling viewers to actually see "behind" the image objects.

Three-point perspective. This perspective is usually used in pictures of buildings seen from above or seen from below. In addition to the two regular vanishing points, there is also one below the ground or up in the sky. Each of the three vanishing points corresponds with one of the three axes of the scene. See *Central perspective*.

Time. Information is most useful to have at exactly the time we need it, too early and too late is of no interest. Thus, when we have access to information is an important factor. A daily paper quickly becomes out-of-date.

Time available. An essential difference between the spoken and the written messages is the time available for transmitting and perceiving them. The speaker and his or her listeners communicate in real time. On the other hand, the writer and the reader can often take all the time that they may need to produce and to read the text respectively.

Time for decisions. When people flip through 15 to 20 television channels in less than a minute to decide which programme they want to see, they do not take the time to actually listen to the sound. Thus, decisions are based on the pictorial style of content.

Time perspective is a *Line perspective*. Using a *time line* makes it easier for the viewer to see the time perspective.

Timeline is a schematic picture. It is typically a simple one-dimensional scale with marks for important events in chronological order. This is often used in graphics and schematic pic-

tures to visualize the relationships between different historical events. See *Diagrams, Priestley*.

Times New Roman. Times New Roman is a common serif typeface. It was designed for hot-metal print and the rotary letterpress printing. Times New Roman combines the classic elegance of typefaces for books with modern demands for economy of space. This compressed Roman serif type has high x-height and thus good legibility even in small font sizes. It became possible to have a lot of text on each page, thus saving paper. It was designed as a newspaper typeface. See *Morison*.

Title Case, each word begins with a capital letter, is sometimes used in titles and in figure texts.

Title pages. A book begins with a title page with the title of the book, the name(s) of the writer(s), and the name of the publisher. On the second page, the imprint page, administrative information such as the name of the document, a document number, a security classification, revision or version number, and date of publication may be provided at the top of the page. Information about the ISBN- or the ISSN-number and the copyright-holder are usually be provided at the bottom of the imprint page: There are usually no pagination on the title and imprint pages.

Tituli, a form of captions. See *Bayeux Tapestry*.

Todd-AO-70 is a wide-film system with large high definition pictures.

Tolerance ranges. There is no unambiguous verbal or visual language. In a closed, homogeneous cultural group, “ordinary”

pictures and texts probably give rise to similar interpretations and perceptions of a specific reality, single object, event, message, or content. However, we do not know the magnitude of the individual “tolerance ranges” in which different texts and pictures generate reasonably identical perceptions. One representation may produce accurate perception of content by one person but a completely different perception by another person.

Tonal perspective. Light tones appear to advance and dark tones appear to recede. A light object against a dark background will normally stand forward, with a strong sense of depth. In practice, it is difficult to distinguish between aerial perspective, colour perspective and tonal perspective.

Tools include: text (printed and spoken), symbols, pictures (drawings and photographs), typography and layout, sound and sound effects. Main production tools include: pens, pencils and other materials for manual work, computers and software to process texts and images, printers, copying machines, printing presses etc., cameras (still, film and video). Main distribution tools include warehouses, stores, different databases and systems like Internet and WWW. Representations of reality can display varying structures, consist of different components and can be related to one another in many different ways. Words and visuals, sound and visuals, or sound, text, and visuals are examples of components that can interact in a message. Tools related to receiver processes include catalogues, directories, databases, indexes, and libraries of different kinds.

Tory. The French humanist Geoffroy Tory (c 1480–1533) may be seen as one of the first graphic designers. Tory was among

the first persons in the world to design books and book pages by editing text and illustrations based on their visual expressions. He designed and published his own first version of a *Book of Hours*, and he broke with all the traditions. Tory became a key figure in printing and publishing during the Renaissance. See *Book of Hours*.

Total information material. A “total information material” is a multi-representational database offering the user complete freedom in shifting back and forth between audio, numeric, verbal, and visual information. A computer program sometimes controls film projectors, videodisc players, and other technical equipment. Total information material offers people with all kinds of modalities to perform their own active searches for information.

Total teaching aid is a multimedia database offering the user complete freedom in moving back and forth between verbal, numerical, visual, and audio information. This will enable children (and adults) with all kinds of modalities, i.e., verbal, visual, kinaesthetic, or mixed modalities, to actively seek and find information that is actively transformed into experience and knowledge.

Toulouse-Lautrec. Henri-Marie Raymond de Toulouse-Lautrec-Monfa (1864–1901) is one of the most well known painters of the Post-Impressionist period. He revolutionized the art of posters and gave the commercial poster status as an independent art form. He became “the king of posters.” He lived a bohemian lifestyle and became the foremost portrayer of the special entertainment world in Paris. The 27-year-old Toulouse-

Lautrec became famous over a night, when his poster *Moulin Rouge: La Goulue* was put on walls and advertising pillars all over Paris in October, 1891.

Transliteracy is the ability to read, write and interact across a range of platforms, tools and media from signing and orality through handwriting, print, TV, radio and film, to digital social networks.

Transportation diagram is a schematic picture. See *Diagrams*.

Tree diagram is a kind of diagram with organizational and hierarchical structures. See *Diagrams*.

Tree structures. Videotex systems, and other menu driven database systems, organize information in hierarchic tree structures. The user navigates by traversing the tree. In order to switch to a different branch one usually has to move all the way back through the structure, and then go deeper into the structure again. The experience of the information is directed and intended, and navigation is regulated. Even though it is possible to have simple images in videotex systems, navigation is based on alphanumeric characters.

Tri-chromatic colour vision system. There are many theories about how perception of colours actually works. In 1807, Young proposed a tri-chromatic colour vision system. In 1924, Young's theory was formalized by von Helmholtz, who proposed hypothetical excitation curves for three kinds of cones in the retina, sensitive for red, green, and blue. See *Colour description systems*.

Tri-linear chart is a schematic picture. See *Diagrams*.

Trustworthiness. A source with a high degree of *trustworthiness* may be described with words like *agreeable, calm, congenial, ethical, fair, forgiving, friendly, gentle, honest, hospitable, just, kind, nice, patient, pleasant, sociable, unselfish, and warm*. The opposite words would describe a source with a low degree of trustworthiness.

Truth. Often people believe that pictures tell the truth. At the same time familiarity with the depicted objects themselves is basic to understanding. The more familiar a message is to its intended audience, the more readily it is perceived.

Two-dimensional representations, like drawings and photographs, are less constrained than interpretation of a verbal message. However, a still picture may always be interpreted in more than one way.

Two-point perspective. Lines that vanish in two directions to two different vanishing points produce a *two-point perspective*. This is also called *angular perspective* and *oblique perspective*. All linear perspectives have exact formulas with many and complicated geometrical and mathematical rules. The two-point perspective can be used to draw all objects. See *Central perspective*.

Type, the characters used to create words in print. See *Cost effective typography, Graphic design genus, Typographic cuing, Typographic decision-making, Typographic style*.

Type measurement systems. Traditionally the vertical height of letters is designated in typographical *points*. However

the size of such a point is somewhat different in various parts of the world. There are three basic measurement systems used for traditional typesetting, and one main system for desktop publishing. See *Desktop publishing systems, Didot system, Mediaan system, Pica system*.

Type of content. It is important to understand the intended content in informative messages and information materials. What is the meaning with informative messages? What is the influence of culture? A “types of content perspective” includes (1) informative entertainment, (2) brief messages, (3) administrative documentation, (4) factual information and (5) instructions. We may also include advertising and propaganda as well as teaching aids in this group.

Regular type is easier to read than uncommon type. Bold-face or italics should normally not be used for continuous text. Italic print is read more slowly than regular type and is also disliked by many readers. Make type big enough to stand out from the background and heavy enough to be visible. Underlining in the middle of a sentence makes the lower line more difficult to read. Professional documents require maximum legibility. Private documents, however, may invite the use of ornate and stylish looking fonts.

Type of representation. A verbal and visual representation can be designed in different ways. Based on how the verbal information is presented to the receivers, we can distinguish three main types of verbal and visual representations.

We read the printed words in (1) lexi-visual representations, such as messages printed in a book or messages displayed on a computer screen. We listen to the spoken words in (2)

audio-visual representations, such as oral presentations with slides or overhead transparencies and in television programmes.

We read printed words and listen to spoken words in a combination of lexi-visual and audio-visual representations in (3) multi-visual representations, such as interactive multimedia systems.

Each “type” can be divided in several sections: 1) Lexi-visual representations. 1a) Manual productions . 1b) Technical productions. 2) Audio-visual representations. 2a) Oral presentations. 2b) Recorded representations. 3) Multi-visual representations. 3a) Interactive systems. 3b) Simulator systems.

Type of search. The “Type of search-dimension” is based on man-machine interaction and restricted by systems design, technology, and computer software. Between the terminal points “regulated and restricted search” and “unregulated and flexible search,” there are systems which can be characterized as hybrid systems. Bibliographic databases, hypertext systems, electronic encyclopaedias on CD-ROM and CD-I, daily papers, video programs, computer games, and expert systems, can be used as examples for illustrating the “Type of search-dimension.” Moving up the scale the systems become more unregulated and flexible.

Type of signs. The “Type of signs-dimension” is a “language-dimension” or “code-system” based on the signs used to represent the information with respect to storage, search, and display. Bibliographic databases, expert systems, hypermedia, papers, video discs, computer games, industrial robots, film and

TV, cruise missiles, and image databases can be used for illustrating this dimension.

Type size, *point size*, is the vertical space allowed for any character of a typeface. See *x-height*.

Typeface. The term typeface refers to the general outline, the face, personality, and shape of the individual characters. During the little more than 500 years of western printing history, probably more than 60,000 typefaces have been designed. It is easy to combine them in many ways. Most of these typefaces are, however, limited in their usefulness. Differences are often subtle. It is not always possible to see the differences without special training. The distinctive details and the explicit forms of words may facilitate word recognition.

Typeface personalities. There are many different and subjective opinions regarding the personalities of typefaces, or perceived personas. Research indicates that the presentation of texts affects the perception of the contents of the message. *Light type* has been described as delicate, gentile, and feminine, as difficult to read and unprofessional, and as insubstantial and timid. *Moderate weight type* has been regarded as professional. *Bold type* has been seen as aggressive, masculine and strong, as difficult to read and unprofessional, as assertive, daring, domineering, overbearing, solid and substantial, as daring, overbearing, stable and substantial.

Types of content perspective. It is important to understand the intended content in informative messages and information materials. What is the meaning with informative messages? What is the influence of culture? A “types of content perspec-

tive” includes 1) informative entertainment, 2) brief messages, 3) administrative documentation, 4) factual information and 5) instructions. We may also include advertising and propaganda as well as teaching aids in this group.

Types of representations. A representation can be designed in different ways. Based on how the verbal information is presented to the receivers, we can distinguish between three main types of verbal and visual representations. We *read* the printed words in 1) lexi-visual representations, such as messages printed in a book or messages displayed on a computer screen. We *listen* to the spoken words in 2) audio-visual representations, such as oral presentations with slides, overhead transparencies or computer-generated images, and in television programmes. We *read* printed words and *listen* to spoken words in a combination of lexi-visual and audio-visual representations in 3) multi-visual representations, such as interactive multimedia systems.

Typographic cuing, the use of bold, italic type or underlining to signal the important ideas in a text on learning. Cuing does work in drawing attention to the cued material. Readers are more likely to remember cued ideas than hunched ideas. In an information or learning material unity can be achieved by using templates for a standardized, structured, and consistent typography and layout.

Typographic decision-making. 1) Use typographic space in a consistent way in order to convey the structure of the information. 2) Use standard page sizes. 3) Use grids for pre-planning of pages.

Typographic style. Characters can be designed in many different ways. Differences between many typefaces are subtle and it is not always possible to see the differences without special training. There are more than 60 000 typefaces. A typeface may be available as light condensed, light, light expanded, bold condensed, bold, bold expanded, regular condensed, regular, regular expanded, extra bold condensed, extra bold, and extra bold expanded. With respect to inclination a typeface may be designed in italic letter style versions. A typeface may also be available as out-lined, in-lined, and shadowed. The “visual weight” varies. It may be compared with physical weight. A complete assortment of characters of the same style and size is called a font of type. The decision of which font, or which fonts, to use should rest largely on the purpose and the audience of the document.

Typographic variation. See *Graphic design genus*.

Typography is the art and technique of arranging type in order to make the message visible and it provides a large number of possibilities to make the structure in a document clear. The graphic designer will select typefaces, point sizes, line length, and line spacing and alter the presentation of headings, running text, captions, lists, tables, and ornaments. See *Cost effective typography*, *Graphic design genus*, *Typographic cuing*, *Typographic decision-making*, *Typographic style*.

U

UltraVision used special cinemas, built between 1966 and 1974. The system used 70-mm film copied from 65-mm negatives. The film was projected on a curved screen. The resolution is 625 pixels per square inch in the middle of the screen.

Unambiguous language. There is no unambiguous verbal or visual language. In a closed, homogeneous cultural group, “ordinary” pictures and texts probably give rise to similar interpretations and perceptions of a specific content, event, message, object, or reality. However, we do not know the magnitude of the individual “tolerance ranges” in which different texts and pictures generate reasonably identical perceptions. One representation may produce accurate perception of content by one person but a completely different perception by another person.

Underlining text. See *Emphasis in text*.

Understanding. If pictures are not adequately discussed and explained, they will probably not be properly understood.

Uninteresting information. See *Information cone*.

Unity suggests an “overall togetherness” in the information material. According to some authors unity is the fabric about which the entire information structure with its text elements and pictures is interwoven. In a design that lacks unity the different elements compete for attention. It is chaos and it creates confusion for the receivers. However, the systems for desktop publishing make it possible for the individual author to integrate words and visuals to aid communication.

All kinds of inconsistencies in an information material may confuse the receivers. It may become unnecessarily complicated for them to interpret and understand the intended content of the message. There is a close relationship between guidelines aimed at providing unity and guidelines aimed at providing harmony. See *Pragmatic unity, Providing unity, Semantic unity, and Syntactic unity.*

Univers is a common sans serif typeface.

Unjustified text. See *Flushed left text.*

Unreadability. The aim of technical writing is to transmit information accurately, quickly and economically from one person to another. Many scientists and engineers make their writing heavily unreadable. Difficult texts have become a global problem in technical and scientific documentation.

Unregulated search. Medical expert systems for diagnosis of diseases is a category of database systems where one usually can search for information with great flexibility. Search is unregulated and flexible, allowing use of synonyms and even broad terms and concepts. The structure of an expert system is usually non-linear. The experience is usually directed and intended, though in more flexible systems experience is likely to be more free and associative. In addition, expert systems might allow the user to search for images and various iconic signs. We can expect rapid developments in expert systems technologies.

Upper case, capital letters of the alphabet (A, B, C etc.).

Usability testing. It may often be a good idea to ask members of the group of intended users to actually use the product in a

realistic situation. This exercise may be video-taped for further analysis. It is also possible to provide the test persons with a set of realistic assignments. They may be asked to communicate their thoughts on how and why they chose to proceed in certain ways. We may also interview the test persons, and give them questionnaires to fill in. Results from these tests should be the basis for revision of next generation of the information material. Designing good information-giving material is a difficult task, but it is one that can be assisted greatly by appropriate usability testing. Users of information products still largely blame themselves when faced with poor design. Thus a push for a research-based information design must come from the information designers. In each case members of the specific user group may be invited to evaluate preliminary texts and sketches for drawings and photographs.

Use of textbooks. Comparisons between old and modern textbooks often show that both the number of pictures, and the space for pictures have increased. Correspondingly the space for text has decreased. After the Second World War the typical textbook author is rather a teacher than a person doing research. Narrative texts have disappeared for the benefit of short, abstract, descriptive, and fragmentary segments of texts. During the years textbooks have more and more illustrations, and a new kind of layout. For each generation the pictures of the textbooks have become more in number, larger, more elegant, and more colourful. An important reason for this is the need for the publishers to be sales oriented. Many colour pictures are used as a competitive means in the continuous battle for more customers.

Use-centred design. Success of a specific design depends on the coordination of the two sets of constraints: information with the appropriate means for action, and the means for action with the appropriate information.

Usefulness. Picture readability is positively correlated with both the aesthetic rating and perceived usefulness in teaching. The aesthetic rating and assessed usefulness in school were also strongly correlated.

User experience, UX, includes affective, experiential, and practical aspects of human-computer interaction. What are the intended audience's attitudes, behaviours, and emotions when using a specific product, service, or system? Is it efficient and easy to use? See *Chief Experience Officer*.

User friendly training environments help learners gain and maintain confidence in their ability to perform in the environment, with minimal confusion. User-unfriendly training environments do the opposite, leaving learners confuse, lost, frustrated, and lacking confidence in their ability to perform satisfactorily.

User interfaces. Good, attractive and intuitive user interfaces are crucial for good user experience. To gain the interest in a new product or technology, users need to understand its advantages or find themselves impressed or involved.

Users. See *Receiver groups*.

Users' viewpoints. Is there a demand for the new medium? Where? Why? For which categories? For which purpose is the new medium intended? Do other media offer the same or cor-

responding services? Which are the unique advantages of this medium that other media are lacking? How is the new medium adapted to reality? Is the medium easy enough to use? Does the user benefit in any way from using the new medium? How? Why? For how long will the medium serve its purpose? Will the media soon be “old-fashioned”? Is there a rapid technical development to be expected within the field that the medium represent? Are the costs of the medium, when it is systematically used, higher than the costs of other media, which provide the corresponding information or experience? Is the cost a critical factor?

Utility/originality rectangle. This preview test is used for assessment of advertisements according to the concepts “utility” and “originality.” First, the extent to which the reader derived any benefit from reading or taking a closer look at an ad is rated. The rating scale range from “no utility” to “great utility.” The degree of execution originality is then assessed. Readers usually subsequently rate ads that are assessed with positive originality and great utility as “good ads.” Publication of an ad with negative originality and little or no utility is virtually pointless.

UX. See *User experience*.

V

Value (sometimes called tone) is the apparent lightness or darkness in anything that is visible. It ranges from white to black.

Value perspective. In art of more ancient date, and even in primitive art, there are many examples of perspective based on *meaning, contents, and value*. The significance, rank, status, or value of depicted objects is evident from the object's size in the picture. Geometrical and mathematical laws are set aside. In Egyptian traditional art, the gods are larger than Pharaoh, who in turn is considerably larger than all his subjects. In several Middle East countries today, the most important person in a group picture is larger in size than the other, less important people. Leaders who happen to be short appear to be "big" leaders since they are the largest in the group. See *Psychological perspectives*.

Values and attitudes. Semantic differential scales in which the sender and/or receivers report how positively or negatively they respond to a given picture in overall terms or with respect to individual picture variables can also be employed in measuring how "good" or "bad" a picture is. Semantic differential scales can comprise general attitude toward a picture (Bad–Good), aesthetic value (Ugly–Pretty), reading value (Uninteresting–Interesting), technical quality (Poor–Good), legibility (Hard to read–Easy to read), educational value (Slight–Great), and credibility (False– True). The combination of verbal and numerical scale steps makes possible statistical calculations of

mean values, standard deviations, and confidence intervals. This makes the method suitable for large groups of subjects.

Vanishing point. See *Central perspective*.

Vector image, or *object-oriented image* is based on mathematical functions and is composed of lines and closed polygons. A coordinate system holds all the information on where lines, circles, squares, rectangles, and other shapes start and stop. Shapes can be filled with various patterns and delineated with different lines. This means that an image can be scaled up and scaled down without loss of quality. The image is re-drawn according to the specifications set by the new size.

Venus is a common sans serif typeface.

Venus of Dolni Věstonice is a 11.1 cm (4.3 in) high statuette of a naked female figure. The 31,000–27,000 years old figurine was found 1925 in Moravia, now located in the Czech Republic.

Venus of Willendorf is a 11.1 cm (4.3 in) high statuette of a naked female figure. The 25,000 years old figurine was found 1908 at a Palaeolithic excavation site near the village of Willendorf, in eastern Austria.

Verbal and visual area diagram is used to compare the relationship between text area, picture area, and background area in graphical messages. This diagram has three axes: text area, picture area, and background area. The three axes are graded from zero to 100 percent. The text and picture axis have a common starting-point, and there is a right angle (90 degrees) between them. The background axis is situated at a 45-degree an-

gel to both the other axis, and it is graded from the outside towards the starting point of the other axis. Consequently, where the text and picture areas are zero, 100 percent is background/emptiness. See *Text, picture, and background*.

Verbal and visual information. Combined verbal and visual information is very important in the natural sciences. In business, engineering, and science, clear thinking is often synonymous with visual thinking. Albert Einstein and several other highly valued thinkers relied on visual images. Visuals may be the main source for information and communication in many cases today.

Verbal communication. We know what we mean. However, we can never be sure that other people perceive our verbal messages as we have intended. On the contrary, people perceive and depict a given message in widely differing ways. Speech reproduction devices often clip higher frequencies, thereby impairing reception conditions for the listener and conveying speech less adequately than direct conversation. Reception conditions of the spoken word conveyed by technical media are similar to the reception conditions of the printed word.

Verbal information. We *read* text in verbal visual representations, and we *listen* to speech in audio-visual representations (the term audio-visual is used here in the traditional sense as a designation for sounds and visuals).

Verbal languages are spoken and written languages. They are similar in many ways. Originally, writing was a way of depicting speech, but the two coded systems have later followed separate courses. Verbal languages have varying levels of meaning: 1)

phonemes (without meaning), 2) morphemes (with meaning), 3) syntagms, sub-meanings, and 4) complete meanings. The most tangible feature of the rules for written language is their standardisation. Semantic codes, grammar, and syntax must be exactly defined. In most western countries, the written language is comprehensible throughout the country and does not reflect differences in dialect. Verbal languages have digital coding using combinations of letters (including numerals) to represent content. There is no direct correspondence between groups of letters, words, and reality. Each meaning is defined and must be learned. See *Spoken languages, Written languages*.

Verbal linguistic perspectives. The concept “perspective” is also used figuratively and in transferred senses. In a situational context, for example, we may say that someone “sees reality from a child's perspective” (viewpoint). We create a mental view of the relative importance of relationships or aspects of a matter or problem.

Verbal messages work well when the content of the message is analytical, detailed, logical, narrative, theoretical, and sequential. Examples of barriers to understanding of a verbal message are: 1) You may not know the meaning of the word which is being used. 2) There can be different meanings of the same word. 3) There can be a misunderstanding of English grammar. 4) There can be a misunderstanding because of context. 5) Sometimes you do not understand the inference. 6) Personal but erroneous explanations.

Verbal symbols, *non-figurative representations*, include verbal descriptions, nouns or labels, and letters and characters. See *Representation*.

Verbal visual continuum is represented by seven types of visuals, ranging from purely verbal to purely visual: 1) Reader Frame (pure verbal). 2) Emphasized Reader Frame. 3) Reader Frame with Visual Cues to Meaning. 4) Verbal/Visual Balanced Frame. 5) Pictorial or Graphic Symbol Frame with Verbal Cues to Meaning. 6) Emphasized Pictorial or Graphic Symbol Frame. 7) Pictorial or Graphic Symbol Frame (pure visual).

Verdana. The type designer Matthew Carter created *Verdana* as a humanist sans-serif typeface for computer screens. It was specifically designed for clarity. Verdana has no serifs, large x-height as well as open and wide characters. The spacing between characters is loose. In contrast to Helvetica similarly shaped characters have emphasized distinctions. Thus Verdana has good legibility on computer screens, even at small sizes.

Vertical bar chart is a schematic picture. See *Bar charts*.

Vertical lines are symbols of power. They often stop eye movements. Vertical lines that are parallel to the borders of the picture give the impression of calm and stability. See *Lines in visual language*.

Vertical perspective. See *Geometrical perspective*.

Vertical spacing is the vertical distance from one baseline to another in a text. See *Leading, Interline distance*.

Vertical type has instability, lightness, and an up-wards aspiration.

Vesalius. Professor Andreas Vesalius (1514–1564) revolutionized the study of biology and the practice of medicine by his careful verbal and visual descriptions of the anatomy of the human body. On the basis of Vesalius' own drawings Johann Stephan van Calcar (1499–1546 or 1550) drew the final illustrations. Andreas Vesalius and Johannes Oporinus (1507–1568) worked together in Basel with an advanced and skilled graphic presentation of the human anatomy in the book *De humani corporis fabrica libri septem* (On the Fabric of the Human Body in Seven Volumes). Johannes Oporinus printed the *Fabrica* in 1543 in a deluxe folio format. The *Fabrica* consisted of 663 pages and 83 plates containing 430 illustrations. Vesalius is called the "founder of modern human anatomy." He was a pioneer in information design.

Video media provide a high level of information content in a simple-to-understand form. Major examples of video media are videotape, videosheet, video discs, and "firm" memory.

Video wall. See *Multivision*.

Videogram is a collective designation for video cassettes and videodiscs, i.e. media for the storage and replay of TV programs at an optional time and place.

Viewer completion. Experienced artists usually leave out most details in their pictures. They have the ability to simplify and in the process, expose significance. They only draw the lines that are necessary to understand the intended content. Our

minds constantly fill in missing details and complete images, most of the time without our realizing that it has happened. The most probable interpretation of the message is created as a meaningful whole. However, the human imagination may be triggered by the design to provide details that will increase viewers' attention and possibly also facilitate learning. In drawings the lines that are missing may be as important as those that actually are there. This is often seen in cartoons.

Viewpoints of the society. What is the value with the new medium? To whom is it “good”? To whom is it “bad”? Why? Is the new medium likely to inflict any laws or ethical roles? Which? To what extent? Is it possible to introduce new taxes? When? How much will it give? Will the new medium influence national security? Why? How much? When?

Virtual classroom. The organization and the actual design of a system for distance education can increase student's attention, motivation and communication. It must be easy for the students to receive information and to communicate with other students. New information has to be displayed when students need it. It is possible to carry out a distance course with few students.

Virtual communities is a major concern in distance education and distance learning. Students need to feel that they belong to a class.

Virtual education is a kind of E-learning. See *E-learning*.

Virtual images created by mirrors, lenses, and other optical systems, can be seen but not “captured” and shown on a screen of any sort. A virtual image is located in a point from which di-

vergent light beams seem to start before they have passed the optical system. Like our inner images, e.g., memories, virtual images lack an obvious physical format. All other kinds of images have a physical format. See *Image morphology*.

Virtual learning environments, *VLE*, is a kind of E-learning. See *E-learning*.

Virtual reality, the display and control of synthetic scenes by means of a computer and peripherals, such as data-gloves, helmets, and joysticks. Systems for virtual reality allow users to vicariously interact within “virtual worlds.”

Visible light ranges from wavelengths of 7 700 angstroms (one Ångström is 0.00077 millimetre), that is, dark red, to 4 000 angstroms, that is, violet. In between these extremes are red (6 500 angstroms), orange (6 000), yellow (5 800), yellow-green (5 700), green (5100), blue-green (5 000), and blue (4 500).

Vision, our ability to see, operates at the level of overt behaviour that enables organisms to avoid predators, find food, find mates, and move around from one place to another in their environments. In subjective terms vision is a complex process that elicits a sense of vision, i.e., awareness of the stimulation of the eye’s vision perception cells. In objective terms, light consists of electromagnetic waves (light “rays”) capable of acting on our eyes and creating sensations of light and images. Human vision is sensitive within a wide wavelength range. The eye’s greatest sensitivity is about 5 550 angstroms. Sensitivity decreases markedly toward the red and violet ends of the spectrum. See

See *Inertia, Optic nerve, Rhodopsin, Visual cortex, Visible light, Visual fields.*

Vistavision is a system for wide-film using standard 35-mm film in a different height-width relationship. In America 1:1.66 is used and in Europe 1:1.85. Vistavision has a resolution of c 150 pixels per square inch in the middle of the screen.

Visuacy. It seems that rather similar concepts have been developed in different places and at different times. Diagrammatic literacy, digital visual literacy, graphicacy, graphical literacy and visual literacy are all concerned with the ability to understand and work with different kinds of visual representations. The term *visuacy* is suggested as an umbrella term for these concepts. See *Visual literacy.*

Visual acuity, our ability to discriminate small objects, peaks at about age 22. Throughout our lives the lenses become less and less transparent. The result of this increasing opacity is that we require more contrast between a message and its background to see any fine details in images and to read text. Usually, there is a constancy of size, shape, colour, brightness, and contrast in the perception of known objects. This is regardless of distance, angle, and illumination.

Visual analysis. In “visual analysis” the term “modality” means how real a representation should be taken to be. Photographs that bear a truthful witness to an event have got “high modality.” These images reflect what we would have seen had we been there. Modality can be decreased or increased. WE can apply “modality scales” to assess the “modality configuration” for an image.

Visual analytics is the science of analytical reasoning supported by the interactive visual interface. The focus is on human interaction with visualization systems as part of a larger process of data analysis.

Visual archaeology is an archaeological method to understand the past through the analysis and interpretations of visual images. Here images are seen as architectural artefacts like pottery and skeletal remains.

Visual channel. Learning is facilitated and maximized when visual, audio, and print contain the same or similar information. We should use pictures: 1) When messages are complex. 2) When referability is important. 3) When messages are long. 4) When environment is noisy. 5) When arrangement is complicated. 6) When precise spatial discrimination is important. 7) When simultaneous presentation is desired. 8) When more dimensions are required.

Visual cognition generally focuses on object recognition and classification and rarely presents any arguments in terms of visual images of aesthetic richness and depth. Visually simple diagrams, representing abstract intellectual theories, are the most common form of visual communication in the literature on visual cognition.

Visual communication. In a society that is becoming increasingly visually oriented and diverse, few people appreciate the critical role of visual literacy and visual communication. The ability for visual communication is becoming more and more important.

Visual content. In the design and production of visuals for information, and instruction, pictures must contain the message they are intended to convey. The visuals must be relevant to the situation, the objectives, and the user characteristics.

Visual cortex. Vision is an extremely complex process. About half of the cerebral visual cortex may be engaged in processing of visual information. Different parts of the visual field have their exact counterparts in the visual cortex. The primary visual cortex is organized into some 2,500 rectangular areas, called "tiles." Each tile have some 150,000 neurons. Each tile receives information only from a small part of the retina. In the tiles neural circuits analyze information about movement, depth, orientation and width of lines and edges, and also colour. Information from each tile is then sent to all sub-regions of the first level of the nearby visual association cortex.

Visual culture is found in every society, in private as well as public life. Visual culture encompasses all visual aspects of each culture, ancient and modern. Visual culture consists of the attitudes, beliefs, conceptual realms, and values that are imbued in artefacts and performances by people that create, present, or use them. Critical reading of visual culture involves learning the skills of deconstruction to more clearly understand how cultural texts actually operate, how they signify and produce meaning, and how they influence and shape their readers. It is immensely important that we correctly interpret the images and designed objects with which we live.

Visual dictionary is a dictionary composed of a series of large images illustrating the meaning of words. The user looks at the

images to find the names of objects as labels, and also the specific parts of the objects. Visual dictionaries are often organized by themes. The words may be printed in one or more languages. There may be an index of all defined words. See *Picture dictionary*.

Visual displays. Compared with traditional graphic presentations, a presentation of information on visual displays is very limited. Still, information may be presented in many different ways. Obviously the use of colour is important. Different “rules of thumb” will apply to different types of presentation. Information, the “message content,” might be represented as text, as numeric data, or as visuals. Visual displays can be built in many ways. A colour television set, an advanced colour terminal, and a liquid crystal display all have very different characteristics. A television set is built to be watched at a distance of more than 120 centimetres. A computer terminal, however, is built to be used at a distance of 60 centimetres and has a much better picture quality. It also costs a lot more.

Visual effectiveness. The effectiveness of a visual depends on the medium, on the type of information, and also on the amount of time learners are permitted to interact with the material. All types of visuals are not equally effective. Line drawings are most effective in formats where the learner’s study time is limited. More realistic versions of artwork, however, may be more effective in formats where unlimited study time is allowed. The realism continuum is not an effective predictor of learning efficiency for all types of educational objectives. An increase in the amount of realistic detail will not produce a corresponding increase in learning. No pictorial image gains the status of a

“statement,” unless an explicit reference is made to what it is supposed to represent.

Visual fields. Since we have two eyes, both pointing forward and with partially overlapping visual fields, we can assess the distance, both forward and laterally, between objects.

Visual grammar. Aristotle had formed the conceptual idea that certain elements of visual grammar are necessary to visual composition and appeal.

Visual graphic design has its roots in the rational, functional aesthetics that evolved in traditional graphic design over the centuries for the print media, and are now used in industrial design, as well as in architecture.

Visual instructions. Pope Gregory the Great (540–604) stated: “What writing is to the reader, pictures are to those who cannot read.” Manuals and instructions have been preserved since the 15th century. From an instructional point of view, there was not much development in visual instructional language from the 15th until the 20th century. The major advance in visual instructions occurred during World War II, when the military used pictorial language to train soldiers.

Visual intelligence. See *Spatial intelligence*.

Visual interface design has a role in the design and development of all kinds of man–machine systems.

Visual language abilities develop prior to and serve as the foundation of verbal language development. Development of visual language abilities is dependent upon receiver interaction

with images, objects, and also body language. Children do not pay attention to factual information in advertising, but rather to peripheral cues such as colour and imagery. They tend to process advertising not through logical assessment, but through their emotions. The same visuals are not equally effective for receivers with different prior knowledge. Images and visual language speak directly to us in the same way experience speaks to us, that is emotionally and holistically. There seem to be no major difference between genders in interpretation of image contents.

Visual language structure. The structure of visual language is formed by different image variables that jointly influence our interpretation of images. Image variables can be subdivided into four main categories: 1) Content, 2) Execution, 3) Context, and 4) Format. All variables in visual language will influence our perception. See *Image content*, *Image context*, *Image execution*, *Image format*.

Visual language variables. See *Visual language structure*.

Visual languages attempt equivalence with reality. Visuals are iconic and normally resemble the thing they represent. It may take only a few seconds to recognize the content in an image. Meaning is apparent on a basic level, but the visual language must be learned for true comprehension. Unlike verbal language systems images and visual language speak directly to us in the same way experience speaks to us: emotionally and holistically. The codes used in visual language differ in different cultures as well as in many sub-cultures. Visual languages have their own “grammars”, syntaxes, etc., just like spoken and written languages. Content is more important than context, execu-

tion, and format. See *Dots in visual language*, *Image content*, *Image context*, *Image execution*, *Image format*.

Visual literacy, *visuacy*, is a broad concept with bits and pieces from several areas of knowledge. Although the term may be modern, it is not a new idea. Ancient philosophers used images for visual communication. There has been, and there still are considerable disagreements among researchers and practitioners concerning a precise definition of visual literacy. It is clear that it is difficult to describe verbally a concept that is primarily nonverbal. Many definitions or explanations of visual literacy, visualization and understanding of pictures have been considered. Here is my own definition: “Visual literacy is the learned ability to interpret visual messages accurately and to create such messages. Thus interpretation and creation in visual literacy can be said to parallel reading and writing in print literacy.” A number of researchers have practically rejected the whole concept of “visual literacy” and they search for something else, like communication design, information design, or message design. Visual literacy may be applied in almost all areas, such as advertising, anatomy, art, biology, business presentations, communication, education, engineering, etc.

Visual learning. See *Learning from visuals*.

Visual literacy, is a broad concept with bits and pieces from several areas of knowledge. There has been, and there still are considerable disagreements among researchers and practitioners concerning a precise definition of visual literacy. It is clear that it is difficult to describe verbally a concept that is primarily nonverbal. See *Visual literacy abilities*, *Visual literacy compe-*

tencies, Visual literacy definitions, Visual literacy objectives, Visual literacy skills, Visual literacy theory.

Visual literacy abilities have been specified as (a) to read/decode/interpret visual statements, and (b) to write/encode/create visual statements. A third visual literacy ability is to think visually.

Visual literacy competencies are defined as reading, planning and creating visuals, and combining visuals and verbal information for intentional communication.

Visual literacy definitions. A large number of definitions and explanations of visual literacy, visualization and understanding of pictures have been suggested. Here is my own definition: “Visual literacy is the learned ability to interpret visual messages accurately and to create such messages. Thus interpretation and creation in visual literacy can be said to parallel reading and writing in print literacy.”

Visual literacy objectives. A visually literate individual should be able to create, plan, and read visuals intended for communication, and also be able to combine visuals and verbal information.

Visual literacy skills range from the ability to distinguish light from dark to the ability to read and express a sequence of body language arranged to express a personal emotion.

Visual literacy theory is grounded on the following five conceptual components: visual language, visual thinking, visual perception, visual communication, and visual learning.

Visual memory is very fast. It is one thousand times faster to view an inner image than to rehearse a word from verbal memory. More details of a mental image of an object are remembered when the object is imagined next to a smaller object. Thus, the relative size of a part of an image may affect our ability to remember and recognize it. See *Memory*.

Visual messages are a powerful form of communication and superior to verbal messages when content is emotional, holistic, immediate, spatial and visual. Images and visual language speak directly to us in the same way experience speaks to us: holistically and emotionally. Factors in visual language are related to criteria such as the content and execution of a visual, its context and format, and the subsequent perception, learning, and memory. Content is more important than execution, context, and format. Pictures have a strong emotional impact. For complex messages combined verbal and visual information may be the best choice.

Visual modality. Children with *visual modality* rely very much on seeing things and on their internal visualisation. They learn by seeing; they are “visual learners.” Thus, these children remember faces rather than names. They must take notes and write down verbal information if they need to remember it. Visual modality children are very quiet. They cannot listen for a long period at a time. Visual learners have vivid imagination. They think in images and visualize in components and details rather than the whole. Visual learners are not particularly responsive to music. See *Modality*.

Visual phonemes. A few researchers have claimed that it is possible to build an iconic “alphabet” and identified six families of basic graphic sign elements, which are called *graphemes*, e.g., “visual phonemes.” Each of these *graphemic sign elements* is part of one of six continuum families: colour, form, grain, orientation, tallness, and value.

Visual presentation of information. Presentation of an intended message involves a wide range of professional interest groups concerned with its development and use. Graphic designers, industrial designers and typographers are primarily concerned with design but will acknowledge the importance of evaluation. Psychologists and ergonomists have an interest in evaluating the effectiveness of displayed information and some, but not all, will acknowledge the importance of graphic design. Architects, planners and engineers have a professional interest in using information as a component in the artefacts they create for society—buildings, roads, industrial machinery and consumer products—but many may not be prepared to acknowledge the importance of design and evaluation of such information. The problem that arises is that each of these professionals approaches information display from a different standpoint—*aesthetic, empirical, evaluative, quantitative, pragmatic, practical*—and also to differing degrees, depending on the relative importance that these aspects have in relation to their own professional interest and obligations.

Visual purple. See *Rhodopsin*.

Visual structures. In the late 1980’s and early 1990’s retrieval systems were able to compare image contents, based on colour,

shape and texture. So far, these systems have limited capabilities and are being employed in industrial robots programmed for taking certain components from a conveyor belt and creating assemblies with other components. Developments are most advanced in the military sector, e.g., in target-seeking missiles capable of reading terrain and comparing readings to a pre-programmed map and a predetermined route to the target. Searching for visual structures in a database is still not very practical, but research in image recognition and image processing will probably make this kind of search more common in future systems. One example is medical information system for detection of cancer cells. Another useful application is searching in image databases for illustrations.

Visual terms. Graphic symbols may be intended to convey generalities of the same order of abstractness as verbal terms. In some cases we can see graphic symbols as visual terms. See *Pictographic languages*.

Visual thinking. In engineering, science, and business, clear thinking is often synonymous with visual thinking. Albert Einstein and several other highly valued thinkers relied on visual images. In many cases visuals may be the main source for information and communication today.

Visualization is any technique for creating animations, diagrams, images, and sketches to communicate messages. It is used education, engineering, medicine, science, technology, etcetera. See *Data visualization*, *Educational visualization*, *Flow visualization*, *Information visualization*, *Network visualiza-*

tion, Product visualization, Scientific visualization, Systems visualization, Technical visualization.

Visualizing. When text and pictures are being produced for informative purposes, it may be a good idea to start by trying to “visualize” the information to be conveyed to the readers. Visualizing a message means that you attempt to materialize it in an effective synthesis of words and pictures. Visualization is usually a complex task, never a single act on its own, and it requires the collaboration of several different parties. Here we can note the following five steps: 1) Requirements. Analyse the commission and the requirements. 2) Receivers. Define the intended receivers of the information. Consider age, gender, and socio-economic factors. Consider views and any other feedback expressed by (previous) receivers. 3) Objectives. Define the objectives for the message. 4) Production. Organize the work. Select a method for framing of the verbal and visual message. Select a suitable medium. Produce synopsis: text and pictures. 5) Reviews. A subject matter review will ensure that the content is relevant to the intended audience. A pedagogical review will ensure that the material is well structured.

Visuals. Drawings and photographs are “two-dimensional” representations. Interpretation of image content is less constrained than interpretation of a verbal message. However, a still picture may be interpreted in more than one way. Furthermore dioramas, models, sculptures and stereo pictures have a third “dimension.” Current laser techniques make it possible to create three-dimensional images, holograms, enabling viewers to see “behind” image objects.

Visuals in teaching aids. It may be concluded that visuals in teaching aids must evoke responses in the reader. To make this possible, the reader must be able to discover the visuals, become interested in them and read them in an active and selective way. It may be good advice to teachers to learn about visual communication and always use pictures in an active way. In my opinion teachers should request quality, and refuse to buy expensive teaching aids with poor quality.

VLE, *Virtual learning environments*, is a kind of E-learning. See *E-learning*.

VLSI. See *Third generation-television*.

Volume in visual language. A volume has a three-dimensional form. The form may be actual or simulated. In two-dimensional representations of three-dimensional objects, shadows are key cues for simulated volumes. We structure the three-dimensional field into various depth planes, or grounds; a foreground, a middle ground, and a background. Like lines and areas, volumes also have several basic properties, such as size, form, colour, surface, structure, contour, direction, weight, position, material, light, architecture, stability, balance, proportions, gravity, and context.

Volume of information. The amount of available information is growing every day. Research and development produce more information than ever before in our history. This growth of available information can be described with a cone, the information cone, which is growing over time. When a subject matter is new, it is easy to have an overall view of all available information. Twenty years ago, one person could have a good

grasp of topics like “optical media” and “multimedia.” It is almost impossible to know everything that is going on within these areas. The need for new ways of navigating and browsing will increase when the amount of information grows and becomes easier and cheaper to store. Design and colour signal different things. Typography and layout of text and pictures should be attractive and stimulate further reading. The graphic design should guide the reader and help her or him to access needed information. Graphic design for information has a clear focus on the primary message.

W

Wall decorations. The Egyptians were the first culture to produce illustrated manuscripts and wall decorations that combined their writing system with illustrations. See *Books of the dead*.

Warning signs. The information designer may be responsible for the appearance of messages in various places such as placements of signs in factory areas, hospitals, sports grounds and other official buildings. Here, the information designer should provide warning signs with properties that are clear and easily noticed in bad and degraded conditions such as fog, weak illumination, and smoke. A printed message must be legible at the appropriate distance, and must often be legible when seen for a short period of time under bad lighting conditions. A driver on a highway may only have a second or two to read a signpost. Then the message in the warning must be mentally processed and understood correctly. Put warning signs close to the hazard, and provide warning signs with adequate reflectance and good lighting equipment. See *Emphasis in signs, Warnings*.

Warnings is a term for a group of information materials in the category *Brief messages*. A warning refers to the designation of a possible hazard that can be avoided by caution and responsible behaviour. Like other instructions, prohibitions and information, warnings can also be impressed or printed on different products, such as machinery in the form of words, letters or symbols designating e.g. an electrical safety hazard or high voltage.

Any warning must attract attention and be readily understood by the intended audience, the persons who need the information. Complex warning messages will need a combination of pictographs and words. Warnings on signs may concern warnings for shallow water or thin ice, warnings to car drivers, pilots, locomotive drivers and machinery operators etc. Warnings of different kinds are often printed on packaging, such as warnings for hazardous substances and warnings on the use of certain drugs in conjunction with driving (as they would make drivers less attentive in traffic). Warnings can be conveyed with acoustic signals, e.g. fire alarms and fire-drill warnings. Warnings may also be issued in weather forecasts, e.g. warnings for icy roads, hail, storms or, at worst, a tornado, things we would rather avoid. See *Warning signs*.

Wayfinding is a term commonly used by designers and manufacturers of signs and signage systems. See *Wayshowing*.

Wayshowing relates to wayfinding as writing relates to reading and as speaking relates to hearing. The purpose of wayshowing is to facilitate wayfinding. Wayshowing is the means. Wayfinding is the end. The introduction of the term wayshowing is an important contribution to information design.

WBT, *Web-based training*, is a kind of E-learning. See *E-learning*.

Web-based training, *WBT*, is a kind of E-learning. See *E-learning*.

Web design. The visual layout as well as the information architecture needs to be user-friendly, and attractive. Many other

researchers have made the same recommendations. In printed material blank space increases cost, since more paper is required. Thus, it is not often used. However, colour as well as blank space on a visual display are essentially free and might be used to increase legibility and readability. The layout of a web site should fit all standards. Despite the increased availability of articles on the topic, one of the primary problems with approaching the concept of ‘Good design’ is not context neutral; specific arrangements that work well for one content area and audience do not automatically work well for all other content areas and audiences. Due to the relatively poor resolution on visual displays and television sets, we should avoid typefaces with very thin lines for texts on these screens.

Web diagram is a kind of diagram for planning and production. See *Diagrams*.

Web meeting. See *Web seminar*.

Web seminar. In a virtual web seminar, a web meeting, a “webinar,” or a “chat,” groups of people have direct contacts to discuss problems.

Webinar. See *Web seminar*.

Wernicke’s area is a posterior zone in the left frontal cortex, involved in the understanding of written and spoken language. It is thought to be the repository for the ideas to be articulated in speech. See *Speech*.

Wertheimer. See *Gestalt principles, Gestalt psychology*.

Wholeness perspective. The sender needs to consider age and gender, cultural, economical, historical, political, religious, and social factors, as well as the amount of data to be used. It is necessary for the sender to employ a total view of all information and all communication. Information should be related to the overall activity goals within an organization. Thus it is important for the sender to employ a wholeness perspective, continuity of operation, competence to make decisions, patience, consistency and a structured way of working. Various messages in different media should work together. In a continuous flow of information the messages will provide the receivers with an image of the organization. This is a typical top-down approach.

Widows. In typography a “widow” is defined as the first line of a paragraph alone at the bottom of a column. Sometimes a widow refers to the last line of any paragraph with only a few words. The first line of a paragraph should not, as a rule, begin on the last line of a text column. Similarly, the last words in a paragraph should not be placed alone at the top of a new page or a new column. Many word processing programs automatically eliminate awkward phenomena like these.

Wind rose chart is a schematic picture. See *Pie charts*.

Windows on computer displays. Employ general design rules for information that is intended to be read on the screen rather than printed on paper. Thus, material should be arranged and displayed so that it is easy to read: from top to bottom and from the left to the right.

Wood engraving. In wood engraving, also called *xylography*, the artist engraves the image in the cross-end of hard timber.

This method was invented in England 1775 and became very important for the production of illustrated newspapers during the 19th century. To be able to prolong the life of the wood engravings, casts in metal, stereotypes, were produced during the middle of the 19th century. Today graphic artists mainly use this method as a fine arts technique.

Woodcuts can be traced back to ancient Egypt, Babylonia, and China, where wooden stamps were used to make decorative patterns or symbols in wax or clay. Blocks may have been used to print textiles in India as early as 400 BC. The oldest book, *The Diamond Sutra*, was block printed in 868 in China. In Europe the oldest coloured woodcut is from 1423. It was hand painted in a few colours. Traditionally artists designed the images for the woodcuts. Then specialist craftsmen, block-cutters, carved the images into the surface of blocks of wood. Usually lines were crude. All areas to show white are cut away. All parts to show black are left. In the printing process these parts are covered with ink that is transferred to parchment, vellum or paper. Movable type and woodcuts can easily be printed together. This was the main technique used for printing illustrated books until the late sixteenth century. Usually illuminators painted illustrations by hand with a few colours. Stencils and templates were often used for this work. In practice this meant that all the books were different in a number of details. Printing with coloured blocks were invented in Germany in 1508. However, colour woodcuts were normally only used for single-leaf prints and not for illustrations in books. During the 18th century artists in Japan produced woodcuts in colour in a masterly way. Today

graphic artists mainly use these methods as fine arts techniques.

Word visuals, reader slides. Many speakers use projected images containing key words in attempting to supply an overview, clarify, reinforce, and summarize complicated arguments. See *Legibility of projected texts, Overhead transparencies, PowerPoint presentations.*

Words. Each meaning is defined and must be learned. In English we use 26 letters in two versions. In a plain, running text most letters are in lower case: a b c d e f g h i j k l m n o p q r s t u v w x y z, but all letters also appear in upper case: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z. We use punctuation marks like these: , . : ; ! ? " () / & % + - = - > < * , and numerals like these: 1 2 3 4 5 6 7 8 9 0. This small number of individual characters can be combined in almost infinite numbers of meaningful permutations. Many words can be formed and arrayed in sentences and texts with completely different meanings. There is a wide carry-over of letter shapes and typefaces from one language to another. Thus the same letters can be used to form meaningful words in many different languages. The properties of letters are limited. A letter has a given position in an alphabet, it has a name, it is represented by one or more sounds, and it is used in a context.

Words and pictures were distinctly separated by the printing technologies for centuries. There was no good method to print text and pictures together with a satisfactory quality until the lithographic process was invented.

Work range. There are many information professions. Groups which mainly work with information, such as e.g. editors, information providers, journalists and marketers, all have similar knowledge of Man and knowledge of information and communications as starting points. They basically utilize the same methods and techniques in their jobs. However, their roles differ in society. Professional roles give each group a special identity and make different demands on loyalty, experience and know-how. The loyalty of an information-provider is to her/his employer. The loyalty of a journalist should be to her/his readers, listeners and viewers rather than to her/his employer.

Workability. The “ability to search for information, make choices, create and package information” is a “workability” oriented view of information design.

Workable whole. Designers have a tendency to combine values and principles discovered by other disciplines into a workable whole that adds up to more than the sum of its parts.

Working materials is a term for a group of information materials in the category *Administrative documentation*. Commonplace objectives may be to work with information by revising, processing and structuring different data. Finding suitable forms for distributing certain information may be important. Examples of common types of working materials are forms/blanks, lists (of various kinds), memos, minutes, notes (taken at meetings) and tables.

Working memory. See *Short-term memory*.

World War II created an enormous instructional problem. Thousands of military personnel had to be trained rapidly to perform thousands of specific tasks, critical to their own survival and the war effort. Agencies within the armed services produced a large number of instructional media, like instructor's manuals, film-strips, slides, audio recordings and also motion pictures. See *Audio-visual instruction, Instructional technologist*.

Working terms. See *Terminology, Terminology work*.

Worm's-eye perspective, *worm's-eye view*, or *frog perspective*, is a level perspective. Here an object is viewed from below (at an oblique angle). This perspective is often used in propaganda. The viewer has to look up to something. In art, film, photography and video a person seen from this perspective look big, important, mighty, powerful, strong and tall. However, a too low view of a person fails to read clearly. This perspective is often used when there are three vanishing points, one on top, one on the left, and one on the right. This is the opposite of a *bird's-eye perspective*.

Worm's-eye view. See *Worm's-eye perspective*.

Wrist-TV. In Japan a wrist-television manufactured by Seiko has been sold since 1985. The system consists of three parts: the actual wristwatch with a television-screen, a receiver to be carried in one's inner pocket, and a headset with an antenna. The image is created by liquid crystals containing 32,000 pixels. The size of the screen is only 17 x 25 mm.

Writer's text is different from the reader's text. See *Text structures*.

Writing. The physical act of writing and drawing one's thoughts with the help of a pen and paper, or a keyboard, or a mouse and a computer, does not usually require a great deal of time. It may take more time to work out how the content of the message may be divided between verbal and visual representations than to actually formulate the contents. See *Writing and drawing processes*.

Writing process. The physical act of writing and drawing one's thoughts with the help of a pen and paper, a keyboard, or a mouse and a computer, does not usually require a great deal of time. It generally takes more time to work out what the text and the pictures should consist of than to formulate the contents. Thus, the writing and drawing processes encompass much more than merely writing and drawing, and they are relatively independent of the language used.

Limit the number of levels in the structure to three or fewer whenever possible. Receivers are liable to have difficulty deciphering and following the structure of an information material if more levels are used. However, in scientific and technical documentation more levels are often required. We all have proficiency in, and insight into, the labours of writing. We all know how writing is done. We know that the writing process consists of more than simply committing words to paper; indeed, it presupposes long-term memory and familiarity with the things that have to do with writing. In other words, writing is an extensive, time-consuming, dynamic, gradual, cognitive and strenuous

business. See *Analysis, Doing the touching-up, Message design processes, Preparation, Writing the text.*

Writing style. The subject matter in technical and scientific texts is often complex and may be difficult to grasp. But what makes a text difficult to read is not as often the subject matter or the combination of spelling, grammar, and syntax as the style. The choice of words, expressions, symbols, and picture elements creates the style. A writing style that includes abstract words, long and complex sentences, stilted language, jargon, and passive constructions may obstruct the reading of the text.

Writing systems were invented at the beginning of the Bronze Age about six thousand years ago. A writing system is an organized and systematic method to use a set of signs or symbols to represent a verbal spoken language. The signs and symbols may be visible or tactile. Writing extends human memory by storage of data and information, and it makes communication of messages possible. There are a large number of writing systems in the world. People need to learn how to encode (write) and decode (read) their writing system. Writing systems are able to express ideas and thoughts. Writing systems may have alphabets, logographies, or syllabaries. Typically writing systems have some kind of grammar and syntax. See *Early writing systems.*

Writing the text, is the third sub-process in the actual writing of a text. Let your writing be simple, clear, and concise. Express yourself in specific rather than unspecific terms. Use a consistent terminology. Analyse, argue, describe, compare, refer, make associations, all according to what you understand is

needed, and much more. See *Message design processes, Writing and drawing processes*.

Written languages. A written text works well when the content of the message is analytical, detailed, logical, narrative, theoretical, and sequential. The text can describe facts as well as feelings as long as the language is comprehensible for the intended audience. People usually have no difficulty in reading the jargon used in professional or technical languages but understanding the concepts that the words represent may be difficult for a non-specialist. The more abstract a word is the harder it is to relate it to any specific activity. See *Verbal languages*.

Written messages. Readability of text is determined by how well the contents and the presentation of the contents are adapted to the readers. It refers to the ease of understanding due to the style of writing. The writer needs to take into account the reader's knowledge, interests, and needs in order to compile, sort, and structure the material.

Written presentations. To be considered verbally literate, one must learn the basic components of a written language: the letters, words, spelling, grammar, and syntax. Just a few basic elements and a set of principles are actually enough to create an almost infinite number of expressions. Most people can learn to communicate with written language. Many develop their own personal styles.

Wrong information. See *Information cone*.

WWW . The pace of development is likely to increase rather than decrease in the future. It is possible that visual messages, and verbal and visual messages, in different forms will become increasingly important in the future when modern information technology like multimedia and the World Wide Web (WWW) are common to many people.

X

x-height, a vertical distance equal to the height of lowercase letters such as x (without ascenders and descenders). Higher x-heights allow for smaller typeface size, which is just as legible but still is space saving and economical. This is important in the production of newspapers.

x-line is a horizontal imaginary line, at the top of lowercase letters such as x. See *x-height*.

Xerography is a dry copying process. The text or image to be copied is projected onto a drum so that an electrostatic discharge is conveyed where the drum is illuminated and stays where the image is black. After that the charged (non illuminated) surface attracts an ink (colour) powder. This is transferred to the paper or to the material onto which the image is to be transmitted. The ink powder is fixed on and inside the paper by heat and pressure.

Xylography. See *Wood engraving*.

Y

Yin and yang in information design. Yin and yang, or yin-yang, is a concept used in Chinese philosophy to describe how seemingly opposite forces are interconnected and interdependent, and how they give rise to each other. Many natural dualities, such as life and death, light and dark, are thought of as physical manifestations of the concept. Yin and yang can also be thought of as complementary forces interacting to form a dynamic system in which the whole is greater than the parts. In information design theory and practice is an example where the whole is greater than the parts.

Young (1807) proposed a tri-chromatic colour vision system. In 1924, Young's theory was formalized by von Helmholtz, who proposed hypothetical excitation curves for three kinds of cones in the retina, sensitive for red, green, and blue.

Z

Zaph Chancery is an example of the script type style. See *Script type style*.

Zetetic design theory relates to the understanding of the performance, in other words, how the model is created. The actions will be perceived as a way of communicating meaning.

Zworykin. The Russian-American inventor *Vladimir Zworykin* (1888–1982) played a role in the practical development of television from the early thirties.